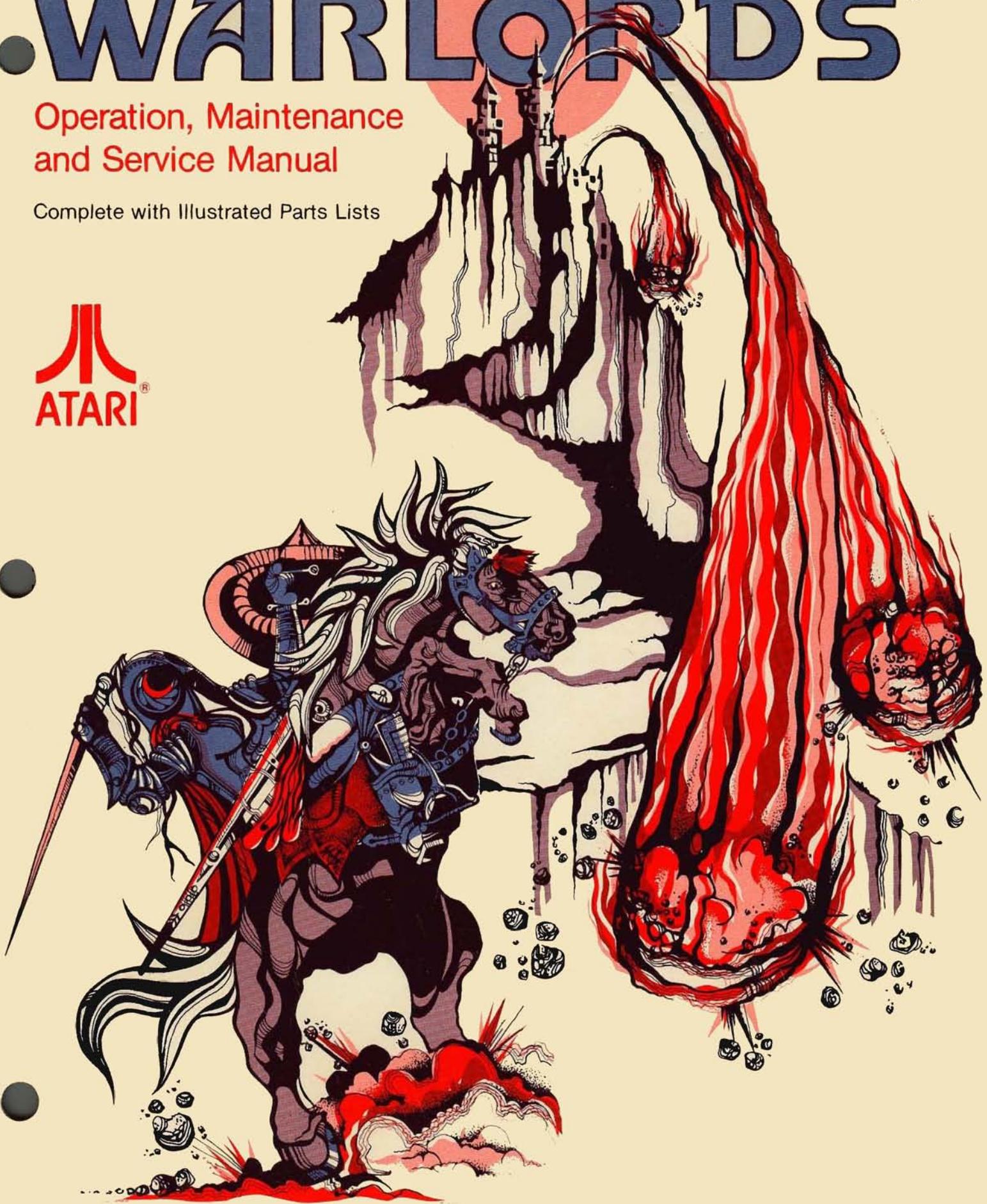


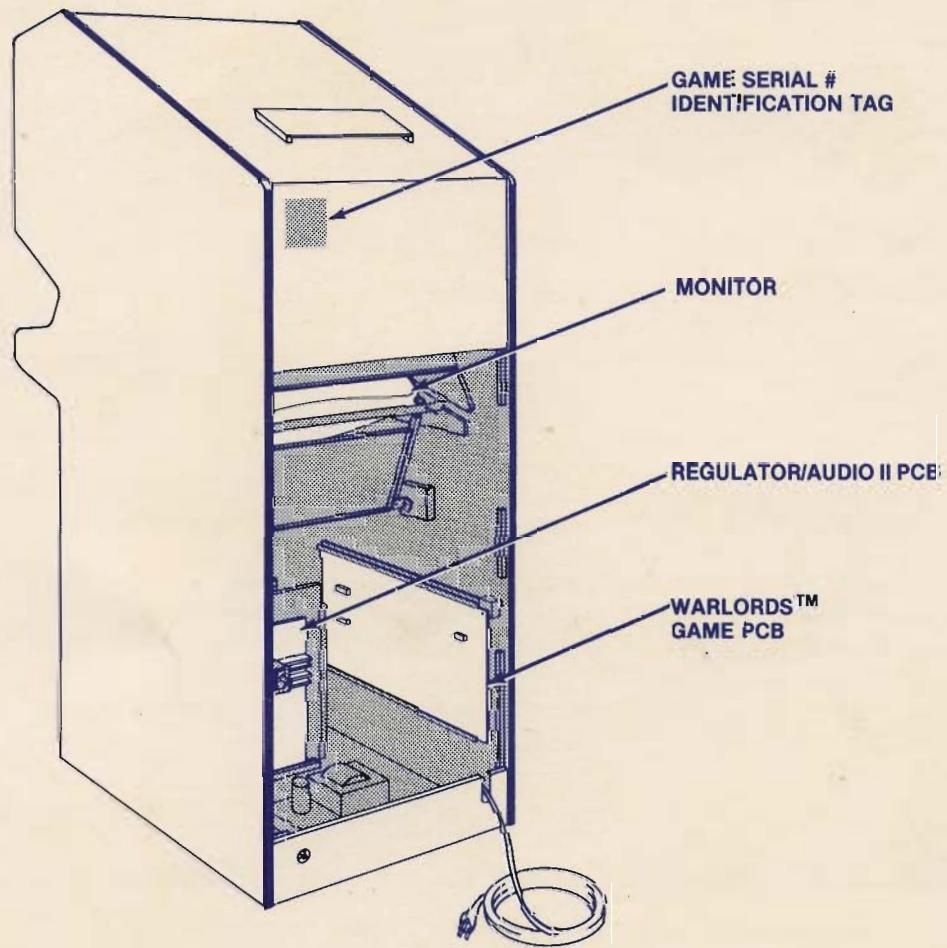
TM-175  
1st printing

# •WARLORDS™

## Operation, Maintenance and Service Manual

Complete with Illustrated Parts Lists





### GAME SERIAL NUMBER LOCATION

Your game's serial number is stamped on a plate on the outside of the game. The same number is also stamped on the chassis of the monitor, Regulator/Audio II PCB, and the Warlords™ Game PCB. Please mention this number whenever calling your distributor for service.

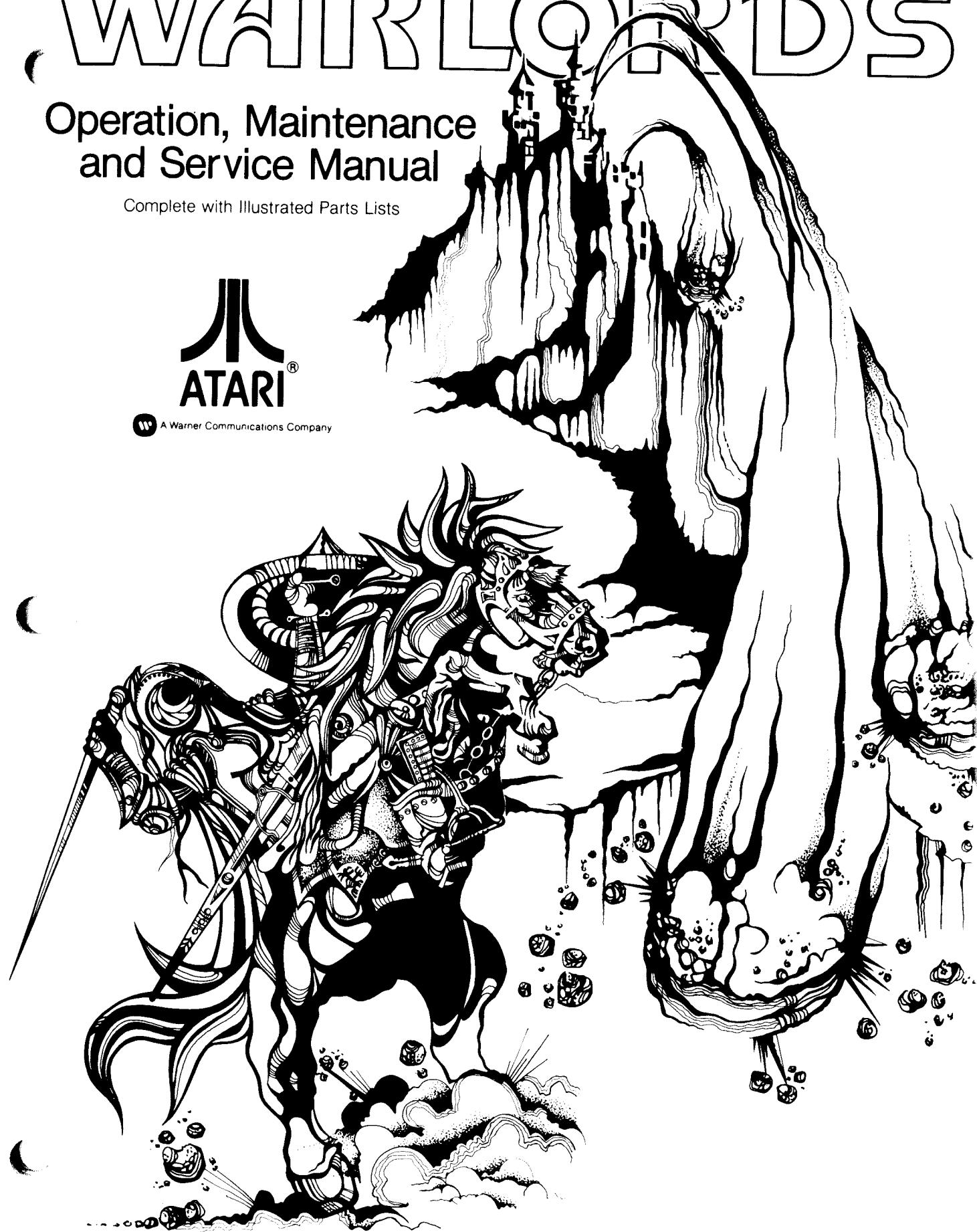
# WARLORDS™

## Operation, Maintenance and Service Manual

Complete with Illustrated Parts Lists



 A Warner Communications Company



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Sunnyvale, California 94086

Lithographed in the U.S.A.      **4K**

## Notice Regarding Non-Atari Parts

### **WARNING**

Use of non-Atari parts or modifications of your Atari game circuitry may adversely affect the safety of your game, and may cause injury to you and your players.

Atari, Inc.'s warranty (printed on the inside back cover of this manual) may be voided, if you do any of the following:

- 1.) you substitute non-Atari parts in your coin-operated game, or
- 2.) you modify or alter any circuits in your Atari game by using kits or parts **not** supplied by Atari.

Not only may the use of any non-Atari parts void your warranty, but any such alteration may also adversely affect the safety of your game, and may cause injury to you and your players.

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## NOTE

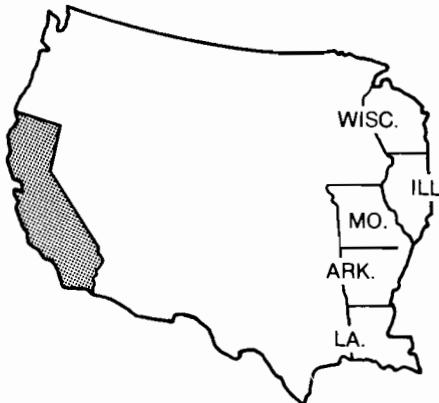
If reading through this manual does not lead to solving a certain maintenance problem, call Tele-Help® at the Atari Customer Service office in your geographical area, as shown below.

## WEST and CENTRAL U.S.A.

Parts for all Atari customers in the U.S.A. Game sales and service

Atari, Inc.  
California Customer Service Office  
1105 N. Fair Oaks Avenue  
P. O. Box 427, Sunnyvale, CA 94086  
Telex 17-1103  
(Monday-Friday, 7:30-4:00 pm Pacific Time)

- ☎ From California, Alaska or Hawaii  
(408) 745-2900
- ☎ From anywhere else in this area  
toll-free (800) 538-1611



## EAST U.S.A.

Game sales and service only

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New Jersey Customer Service Office  
Cottontail Lane, Somerset, NJ 08873  
Telex 37-9347  
(Monday-Friday, 7:30-4:00 pm Eastern time)

- ☎ From New Jersey  
(201) 469-5993
- ☎ From anywhere else in this area  
toll-free (800) 526-3849



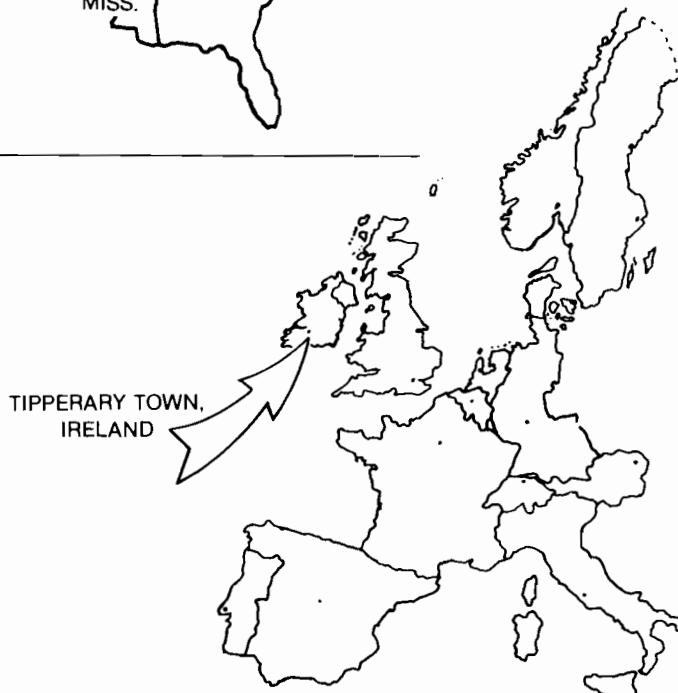
## EUROPE

Parts for all Atari customers in Western Europe.

Game sales and service

Atari Ireland Limited  
European Customer Service Office  
Tipperary Town, Ireland  
Telex 28165  
(Monday-Friday, 9:00-6:00 pm GMT)

- ☎ 062-52155





## A. New Features

The Warlords™ game has one new part. Even if you are familiar with Atari games, you should note this important difference. The new part is:

- **Deep-Well Coin Box.** This new coin box conservatively holds \$600 in U.S. quarters. Please note that \$500 in quarters weighs over 11 kg (25 lbs.), and \$600 in quarters weighs  $12\frac{3}{4}$  to  $13\frac{1}{2}$  kg (28-30 lbs.).

This new part, as well as all other major parts in the game, are illustrated in Figure 1. Throughout this manual, wherever this new part is mentioned, you will see this symbol:



## Location Setup

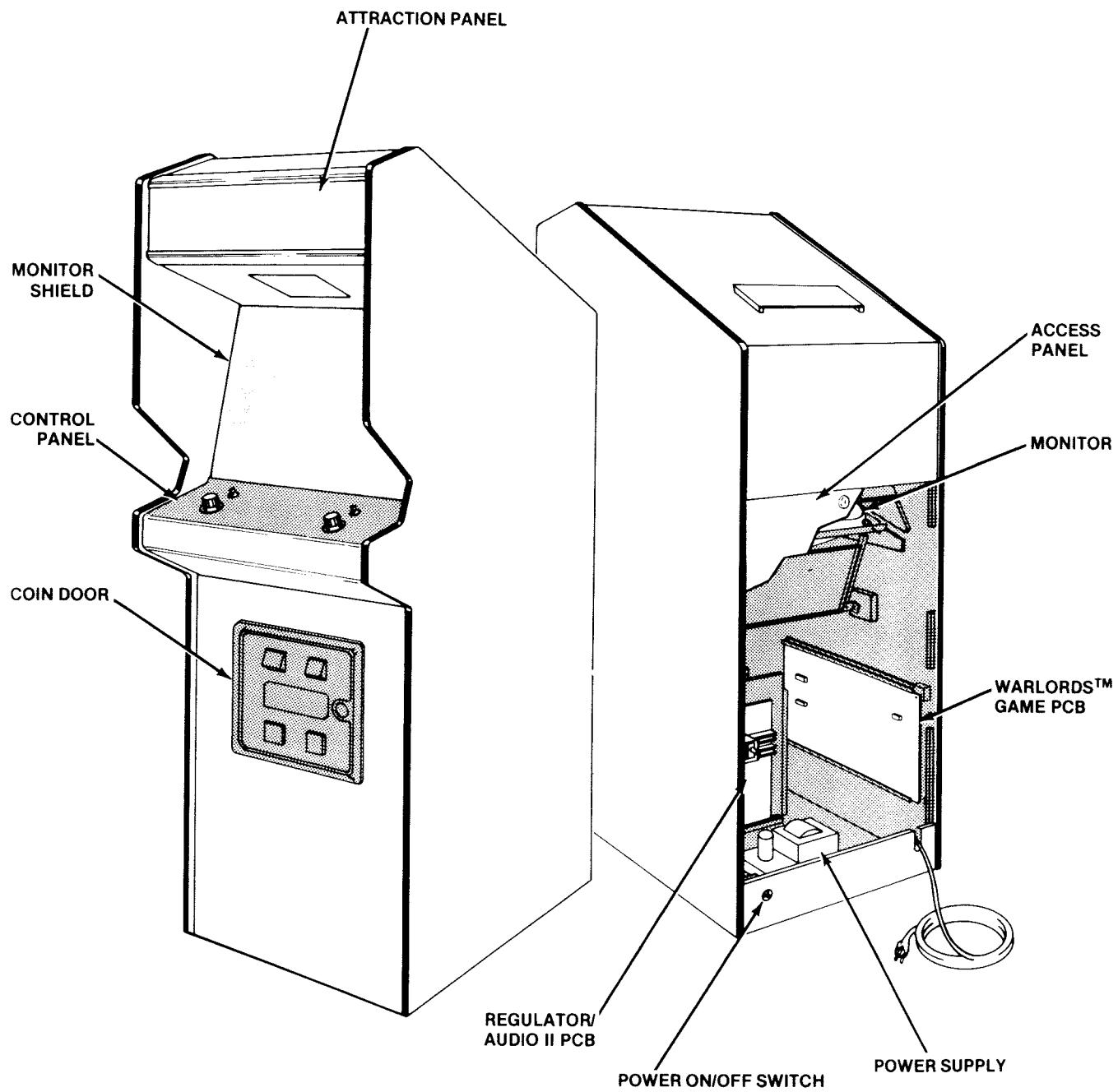


Figure 1 Overview of Game

## ! — WARNING: — !

### SHOCK HAZARD

Connect this game only to a grounded 3-wire outlet. If you have only a 2-wire outlet, we recommend you hire a licensed electrician to install a grounded outlet. **Players may receive an electric shock if this game is not properly grounded!**

## B. Game Inspection

This new game is ready to play upon removal from the shipping carton. However, your careful inspection is needed to supply the final touch of quality control. Please follow these steps to help us insure that your new game was delivered to you in good condition.

### NOTE

Do not plug the game in yet!

1. Examine the exterior of the game cabinet for dents, chips, or broken parts.
2. Unlock and open the access panel of the cabinet and inspect the interior of the game as follows:
  - Check that all plug-in connectors (on the game harness) are firmly seated. Replug any connectors found unplugged. DON'T FORCE CONNECTORS TOGETHER. The connectors are keyed so they only go on in the proper orientation. **A reversed edge connector will damage a PCB and will void your warranty.**
  - Check that all plug-in integrated circuits on the game PCB are firmly seated in their sockets.

## ! — WARNING — !

To avoid possible unpleasant electrical shock, do not touch internal parts of the monitor with your hands or metal objects held in your hands!

- Note the location of the game's serial number—it is printed on the special label on the outside of the game cabinet. Verify that the serial numbers also stamped on the Warlords™ Game PCB, Regulator/Audio II

PCB, and monitor are all identical. A drawing of the serial number components is on the inside front cover of this manual. Please mention this number whenever you call your distributor for service.

- Check all major subassemblies such as the power supply, control panel and monitor for secure mounting.

## C. Game Installation

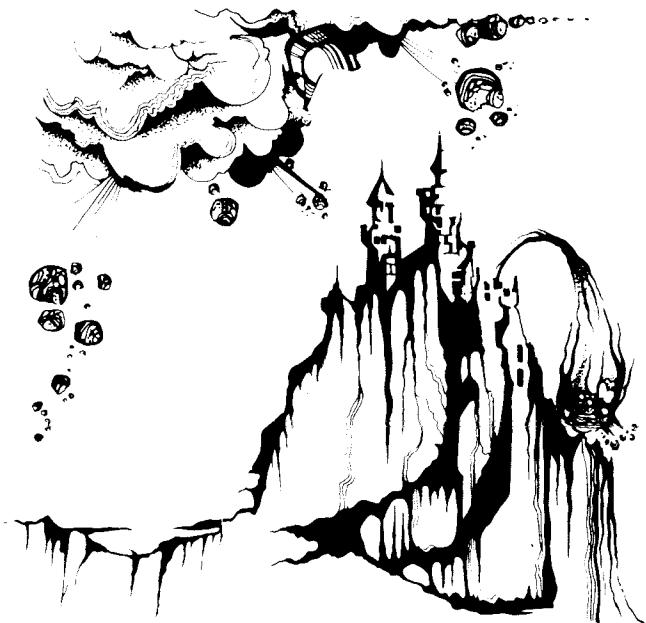
### Figure 2 Installation Requirements

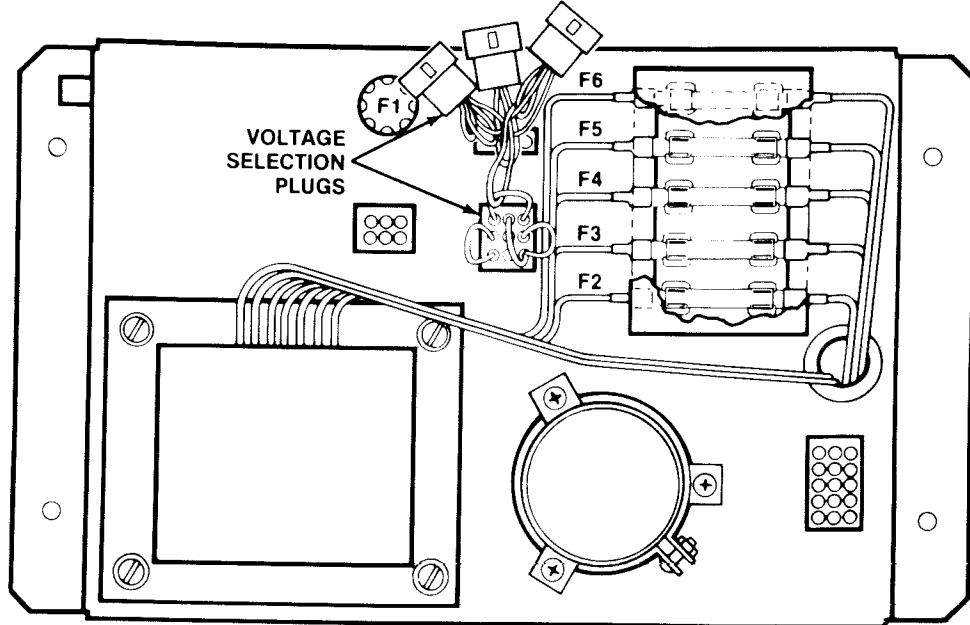
|                |                            |
|----------------|----------------------------|
| Power          | 125 watts                  |
| Temperature    | 0 to 38°C (32 to 100°F)    |
| Humidity       | Not over 95% relative      |
| Space Required | 64 × 81½ cm (25½ × 32 in.) |
| Game Height    | 182½ cm (71¾ in.)          |

### 1. Voltage Selection

The power supply in this game has four colored voltage selection plugs and operates on the line voltage of almost any country in the world.

Before plugging in your game, check your power supply. Make sure that the voltage selection plug on the power supply is correct for your location's line voltage. Check the wire color on the plug and see if it is correct per Figure 3.



**Line Voltage Range**

90-110 VAC (100)  
105-135 VAC (120)  
200-240 VAC (220)  
220-260 VAC (240)

**Voltage Selection Plug Color**

Violet  
Yellow  
Blue  
Brown

**WARNING**

Fuse cover must be in place during game operation.

**Figure 3 Voltage Plug Selection**

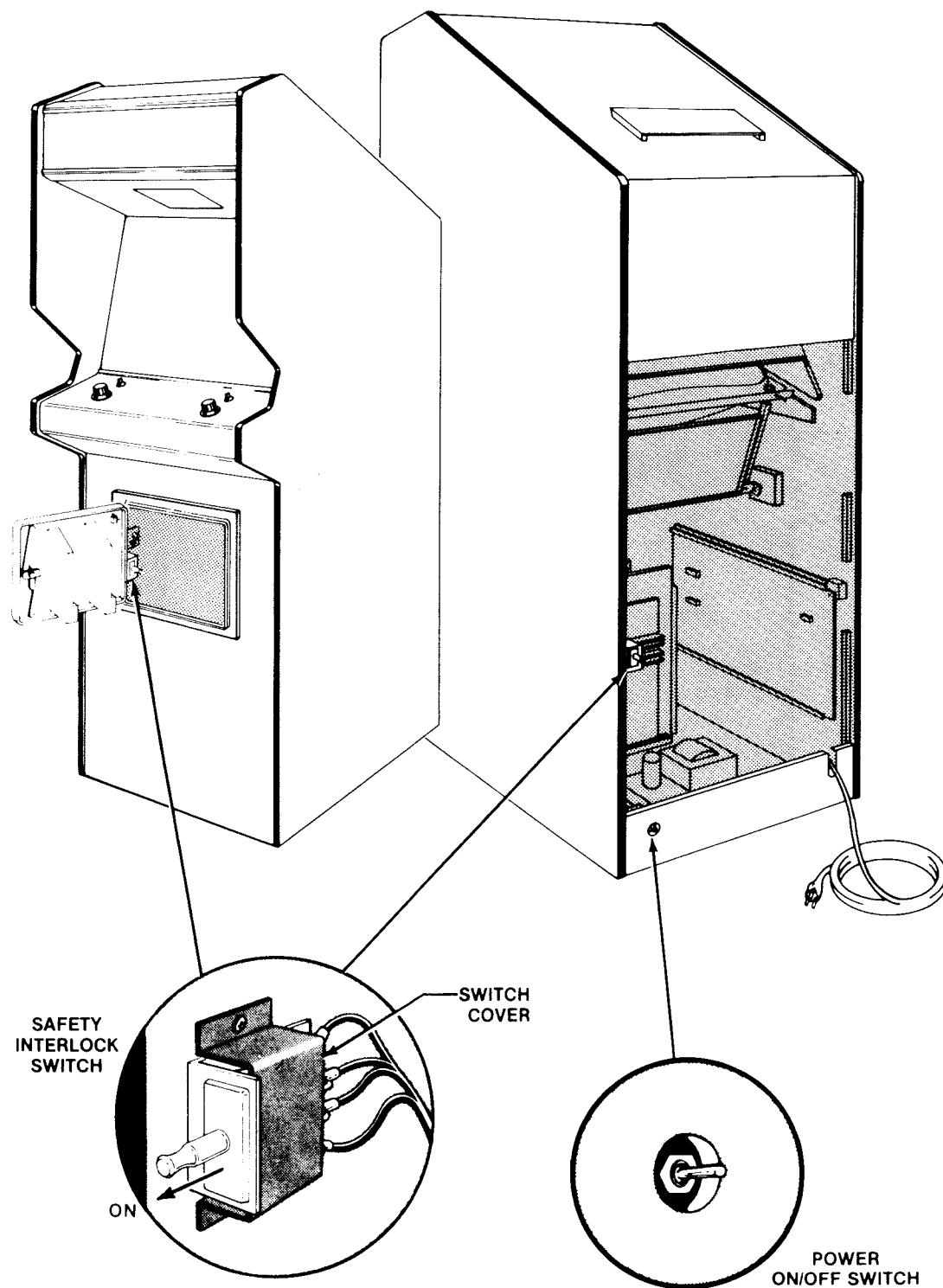
## 2. Interlock and Power On/Off Switches

To minimize the hazard of electrical shock while working on the inside of the game cabinet, two interlock switches have been installed (see Figure 4). One is located behind the access panel and one is behind the coin door. These switches remove all AC line power from the game circuitry when a door is opened.

Check for proper operation of the interlock switches by performing the following steps:

- Be sure the coin door and rear access panel are closed.

- Plug the AC line power cord into an AC outlet.
- Set the power on/off switch to the "on" position. Within 30 seconds the monitor should display a picture.
- Slowly open the rear access panel. The monitor picture should disappear when the door is opened approximately 2.5 cm (1 inch). Close and lock this panel and repeat this step with the coin door.
- If the results of the preceding step are satisfactory, the interlock switches are operating properly. If the monitor doesn't go off as described, check to see if the corresponding interlock switch is broken from its mounting or stuck in the "on" position.



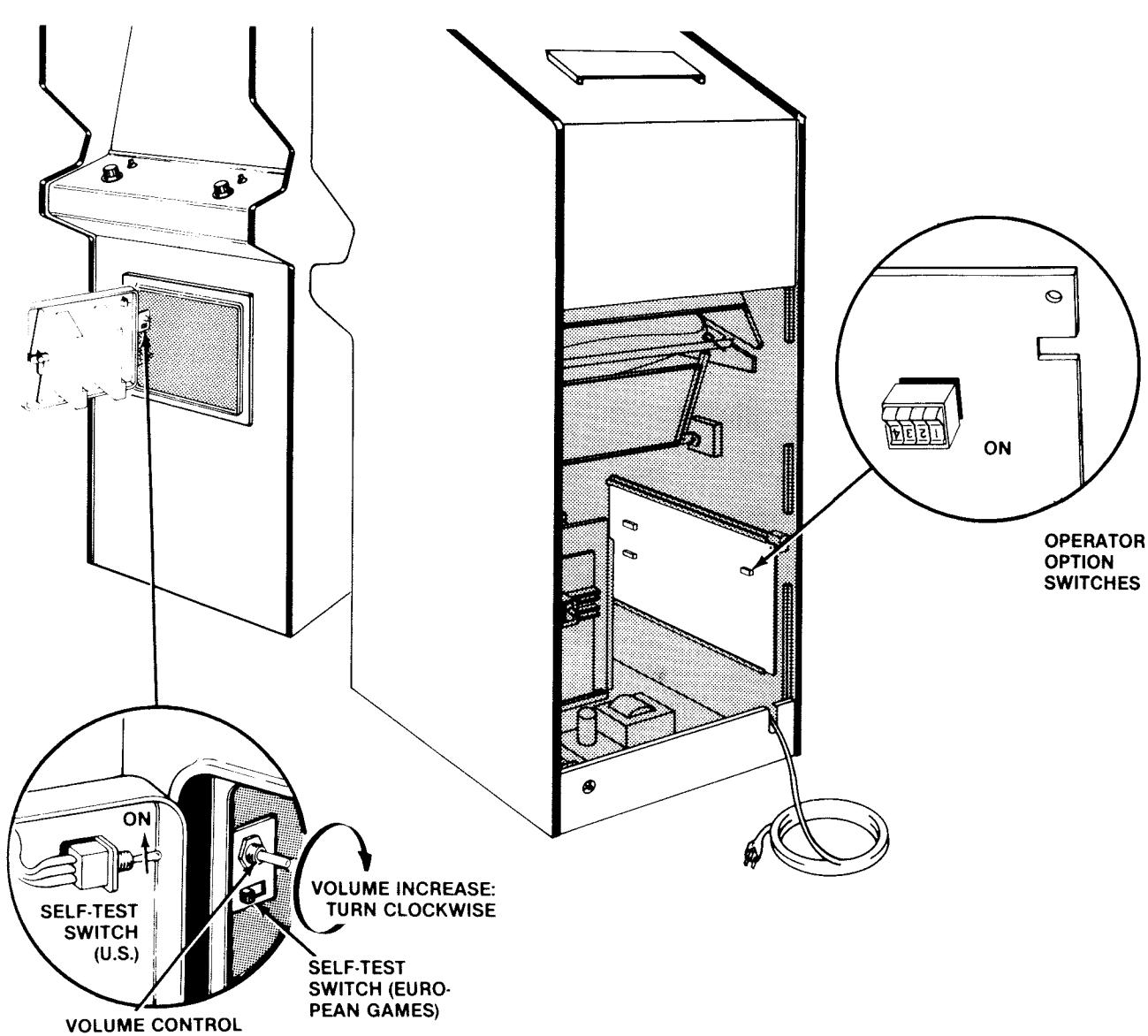
**Figure 4 Interlock and Power On/Off Switches**

## D. Self-Test Procedure

This game will test itself and provide data to demonstrate that the game's circuitry and controls are operating properly. The data is provided on the monitor, the light-emitting-diode switches, and the game speaker; no additional equipment is necessary.

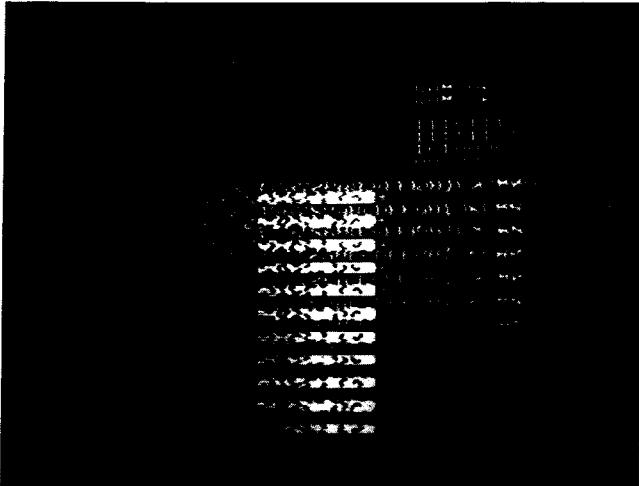
Part of the self-test procedure includes a display of the operator-selectable game options. Therefore, we suggest you run the self-test procedure anytime you need to change the game's options.

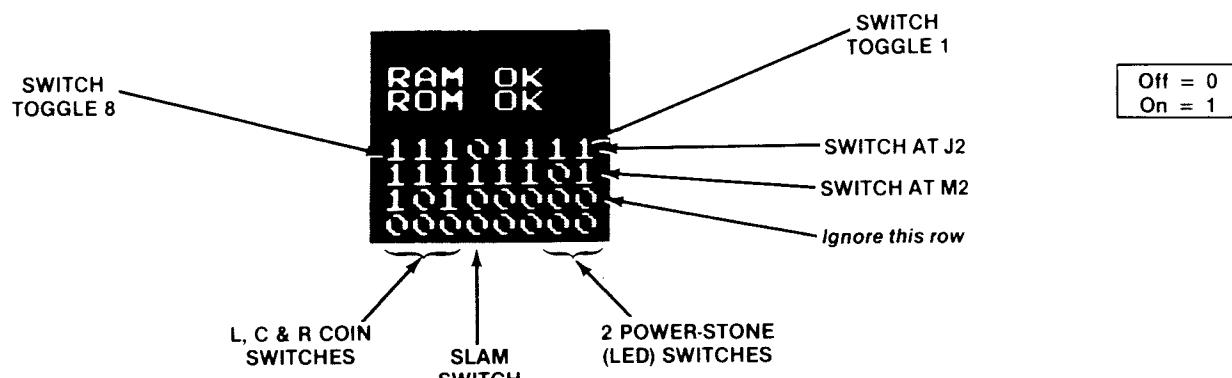
To run the self-test, follow the instructions outlined in Figure 6.



**Figure 5 Location of Self-Test Switch, Volume Control and Option Switches**

## Figure 6 Self-Test Procedure

| Instruction   | Results if<br>Test Passes   | Results if Test Fails  |
|---|---|--|
| 1. Unlock and open the coin door. Set self-test switch to <b>on</b> position (see Figure 5).            | The monitor displays the picture below. You may hear a ticking sound. This is normal.   | <b>RAM FAILURE</b> is indicated by the message <i>BAD RAM</i> .<br><b>ROM/PROM FAILURE</b> is indicated by the message <i>BAD ROM</i> .  |
|   |    |  |
| 2. Turn each shield control knob slowly back and forth and observe the monitor.                         | A fireball will move smoothly on a diagonal across the screen. Ignore any "wraparound" that the fireball does on the screen.  | A fireball will jump erratically or not move at all, indicating a bad potentiometer or loose harness wires.  |
| 3. Activate the following switches: slam, coin mechanism, and two LED switches.                         | You will hear a high tone; also, one of the characters in the 4th row of 0s and 1s on the screen will change to a 1 (on). Simultaneously pressing more and more switches will progressively lower the tone. Tone disappears when all switches are released. | A low tone produced while you are not pressing any switches indicates at least two switches are shorted together.<br><br>No sound at all indicates bad sound circuitry, loose speaker wires, bad switch circuitry or volume control turned all the way down. |
| 4. When satisfied with test, set self-test switch to <b>off</b> position. Close and lock the coin door. | All coin acceptor and LED lamps are lit.  | Either some or all lamps are dark (burned out).  |



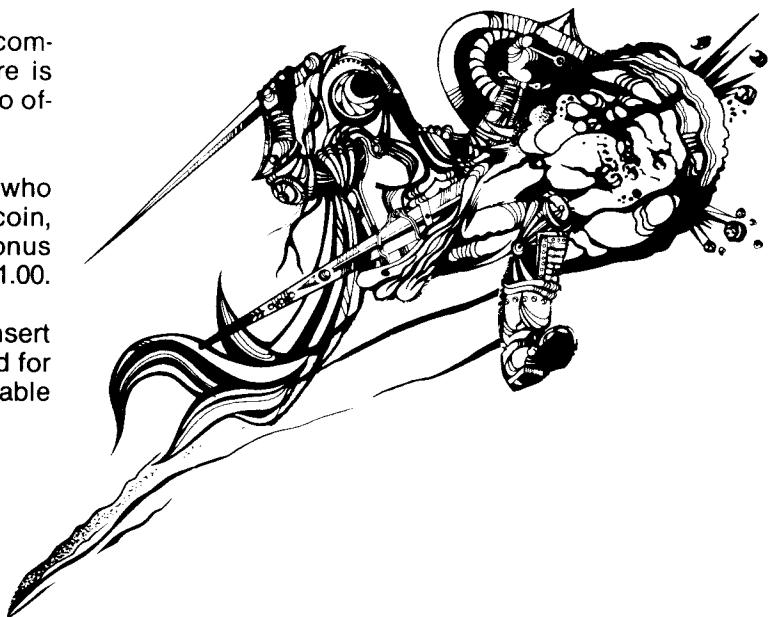
## **E. Option Switch Settings**

## 1. Bonus Play Feature

Warlords™ offers a bonus play for certain combinations of coins inserted. This bonus feature is operator-selectable, meaning you may choose to offer it or not.

With your game set at 50¢ per play, players who deposit four successive quarters or a \$1.00 coin, then press the start button, can receive a bonus play. Therefore, players can receive 3 plays for \$1.00.

This bonus feature encourages players to insert more money than just the minimum 50¢ required for one game. Various other bonuses are also available (see Figure 8).



## **Figure 7 Game Option Settings**

To change toggle positions on the switch assemblies, you need not remove the game PCB. The switches, usually colored blue, are easily accessible when the Warlords™ Game PCB is mounted in place.

When changing the options, verify proper results on the monitor display **by performing the self-test**. Note that changing an option on any of the following eight toggles will cause an immediate change on the monitor screen during the self-test.

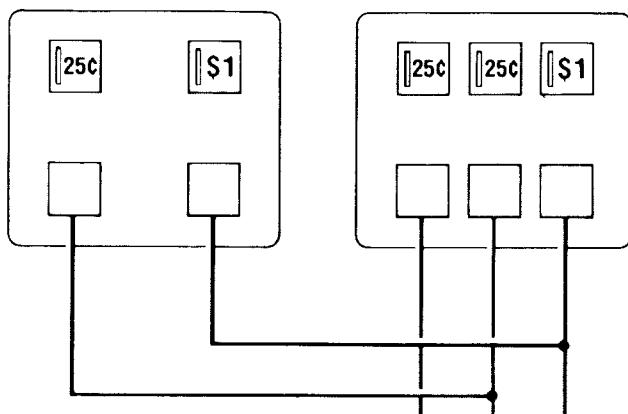
| Toggle Settings of 8-Toggle Switch on Warlords PCB<br>(at J2—CENTER LEFT switch when PCB is in game) |          |          |          |     |     |     |     |   |
|--|----------|----------|----------|-----|-----|-----|-----|---|
| 8  | 7        | 6        | 5        | 4   | 3   | 2   | 1   | Option  |
| Not Used   | Not Used | Not Used | Not Used | On  | On  | On  | On  | English language \$   |
|  |          |          |          | On  | Off | Off | Off | French language   |
|  |          |          |          | Off | On  | On  | On  | Spanish language  |
|  |          |          |          | Off | Off | Off | Off | German language   |
|  |          |          |          | On  | Off | On  | Off | Music ends each game. \$  |
|  |          |          |          | On  | Off | On  | Off | Music at end of game only for a new high score<br>(1- and 2-player games only). |
|  |          |          |          | On  | On  | On  | On  | 1- to 2-player game costs 1 credit.   |
|  |          |          |          | On  | Off | On  | On  | 1-player game costs 1 credit; 2-player game costs 2 credits. \$                 |
|  |          |          |          | Off | Off | Off | Off | 1- to 2-player game costs 2 credits.  |
|  |          |          |          | Off | On  | On  | On  | Not Used.   |

**\$ Manufacturer's suggested settings**  
For pricing for "credits", see Figure 9.

## 2. Coin Mechanism Multipliers

Since early in 1980, Atari has made available its new coin door which has either two or three mechanisms. All recent Atari game PCBs identify the different mechanisms in a certain pattern.

The right coin mechs are all the same to the game's logic, regardless of whether you have two or three mechs in your door. In addition, the logic sees the left mech in a 2-mech door and the center mech in a 3-mech door as the same. Refer to the diagram below.



This pattern is important for you to know, so you can correctly set the "multipliers" for each mech. The multipliers determine how much each mechanism will be worth to the game's logic.

The basic unit of measurement is 25¢, which equals a multiplier of  $\times 1$ . Therefore, if you have a 25¢/25¢/\$1 coin door, you will probably want to set the center and right option-switch multipliers at  $\times 1/\times 4$ . (The left mech in a 3-mech door always has a value of  $\times 1$ —you cannot change its value.)

You can set these multipliers with toggles 3 thru 5 on the Warlords™ PCB switch assembly at location M2. For exact settings of these toggles, refer to Figure 8.

## 3. Examples of Game Price Settings

Figure 8 explains the options, giving twelve examples of the most common U.S. situations. The toggles mentioned below are all in the switch at location M2; they **only** relate to game price, coin mechanism multipliers, and bonus plays. You should set the toggles relating to other functions as you see fit, although Figures 7, 8, and 9 provide "\$" symbols indicating Atari's recommendations.



## Figure 8 Game Price Settings

The white block below contains Atari's suggested settings. All numbers 1 thru 8 are toggle settings on the 8-toggle switch at location M2, on the Warlords™ game PCB (the **UPPER LEFT** switch assembly).

### 50¢ PER CREDIT:

|   | No bonus |         |          |          | Bonus<br>\$1.00 = 3 credits |     |         |          | Bonus<br>\$1.00 = 3 credits |          |     |         |          |          |          |
|---|----------|---------|----------|----------|-----------------------------|-----|---------|----------|-----------------------------|----------|-----|---------|----------|----------|----------|
| Straight<br>25¢ Door                            | (1)      | 8<br>On | 7<br>On  | 6<br>On  | 5<br>On                     | (3) | 8<br>On | 7<br>Off | 6<br>Off                    | 5<br>On  | (4) | 8<br>On | 7<br>On  | 6<br>Off | 5<br>On  |
|   |          | 4<br>On | 3<br>On  | 2<br>Off | 1<br>Off                    |     | 4<br>On | 3<br>On  | 2<br>Off                    | 1<br>Off |     | 4<br>On | 3<br>On  | 2<br>Off | 1<br>Off |
| 25¢/\$1.00<br>Door or<br>25¢/25¢/\$1.00<br>Door | (1)      | 8<br>On | 7<br>On  | 6<br>On  | 5<br>On                     | (3) | 8<br>On | 7<br>Off | 6<br>Off                    | 5<br>On  | (4) | 8<br>On | 7<br>On  | 6<br>Off | 5<br>On  |
|   |          | 4<br>On | 3<br>Off | 2<br>Off | 1<br>Off                    | (5) | 4<br>On | 3<br>Off | 2<br>Off                    | 1<br>Off | (5) | 4<br>On | 3<br>Off | 2<br>Off | 1<br>Off |

### 25¢ PER CREDIT:

|   | No bonus |         |          |          | Bonus<br>\$.50 = 3 credits |     |         |          | Bonus<br>\$1.00 = 5 credits |         |     |         |          |          |         |
|---|----------|---------|----------|----------|----------------------------|-----|---------|----------|-----------------------------|---------|-----|---------|----------|----------|---------|
| Straight<br>25¢ Door                            | (2)      | 8<br>On | 7<br>On  | 6<br>On  | 5<br>On                    | (7) | 8<br>On | 7<br>On  | 6<br>Off                    | 5<br>On | (7) | 8<br>On | 7<br>Off | 6<br>On  | 5<br>On |
|   |          | 4<br>On | 3<br>On  | 2<br>Off | 1<br>On                    |     | 4<br>On | 3<br>On  | 2<br>Off                    | 1<br>On |     | 4<br>On | 3<br>On  | 2<br>Off | 1<br>On |
| 25¢/\$1.00<br>Door or<br>25¢/25¢/\$1.00<br>Door | (2)      | 8<br>On | 7<br>On  | 6<br>On  | 5<br>On                    | (7) | 8<br>On | 7<br>On  | 6<br>Off                    | 5<br>On | (7) | 8<br>On | 7<br>Off | 6<br>On  | 5<br>On |
|   |          | 4<br>On | 3<br>Off | 2<br>Off | 1<br>On                    |     | 4<br>On | 3<br>Off | 2<br>Off                    | 1<br>On |     | 4<br>On | 3<br>Off | 2<br>Off | 1<br>On |

Circled numbers refer to coin-door labels you should use with each situation (labels are illustrated on the following page).

## Figure 8 Game Price Settings, continued

For your information, we have defined below the switch settings for those options relating to game price, coin mechanism multipliers, and bonus play. This information is useful in case you

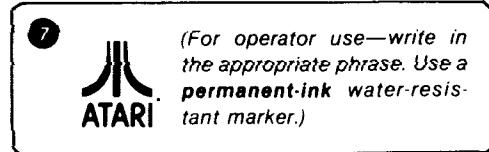
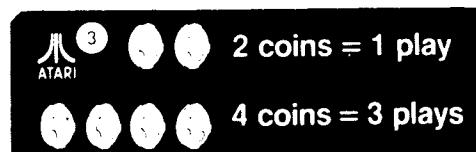
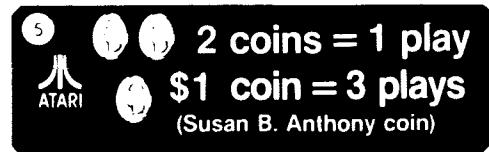
need to temporarily set the Warlords™ game on free play, or if you have German coin mechanisms in your door.

| Toggle Settings of 8-Toggle Switch on Warlords PCB (at M2—UPPER LEFT switch when PCB is in game) |     |     |   |   |   |     |     |   |
|--|-----|-----|---|---|---|-----|-----|---|
| 8  | 7   | 6   | 5 | 4 | 3 | 2   | 1   | Option  |
|  |     |     |   |   |   | On  | On  | Free play   |
|  |     |     |   |   |   | On  | Off | 1 coin* for 2 credits   |
|  |     |     |   |   |   | Off | On  | 1 coin* for 1 credit \$                                       |
|  |     |     |   |   |   | Off | Off | 2 coins* for 1 credit   |
|  |     |     |   |   |   | On  | On  | Right coin mech x 1 \$  |
|  |     |     |   |   |   | On  | Off | Right coin mech x 4   |
|  |     |     |   |   |   | Off | On  | Right coin mech x 5   |
|  |     |     |   |   |   | Off | Off | Right coin mech x 6   |
|  |     |     |   |   |   | On  |     | Left coin mech x 1 \$   |
|  |     |     |   |   |   | Off |     | Left coin mech x 2  |
| On   | On  | On  |   |   |   |     |     | No bonus coins  |
| On   | On  | Off |   |   |   |     |     | For every 2 coins* inserted, game logic adds 1 more coin*     |
| On   | Off | On  |   |   |   |     |     | For every 4 coins* inserted, game logic adds 1 more coin*     |
| On   | Off | Off |   |   |   |     |     | For every 4 coins* inserted, game logic adds 2 more coins* \$ |
| Off  | On  | On  |   |   |   |     |     | For every 5 coins* inserted, game logic adds 1 more coin*     |

\*In the U.S., a coin is defined as 25¢. In Germany a coin is 1 DM.

### \$ Manufacturer's suggested settings

To receive any bonus "coins" from the game logic (as listed in the last four settings above), players must insert all coins before pressing any start button.



## Figure 9 Coin Counter Option Settings

*[These toggles determine which coin mechanisms activate which counters]*

| Toggle Settings of 4-Toggle Switch on Game PCB (L9) |     |     |   | Two coin acceptors in the coin door:  | Two coin acceptors and a push-button utility coin switch in the game:  | Three coin acceptors in the coin door: |
|---|-----|-----|---|---|--|--|
|   | 4   | 3   | 2   | 1   |  |  |
| Not Used  | On  | On  | Both acceptors activate all coin counters simultaneously. | <i>Do not use this setting.</i>   | All 3 are same denomination and they activate all coin counters simultaneously.  |  |
|   | Off | On  | Both acceptors activate 2 counters separately.            | <i>Do not use this setting.</i>   | Left and center acceptor activate one coin counter; right acceptor activates another coin counter.   |  |
|   | On  | Off | Both acceptors activate all coin counters simultaneously. | Utility coin switch will not activate a coin counter, if you do not hook up it up. Both acceptors activate all coin counters simultaneously.  | Left acceptor activates one coin counter; center and right acceptor activate another coin counter. <i>Not for any currently designed 3-mech coin door.</i> |  |
|   | Off | Off | Both acceptors activate 2 counters separately. \$         | Utility coin switch will not activate a coin counter, if you do not hook it up. Left and right acceptors activate 2 coin counters separately. | Left, center and right acceptors activate 3 coin counters separately. \$   |  |

\$ Manufacturer's suggested settings

## F. Game Play

Atari's Warlords™ is a one- or two-player game with a black-and-white raster-scan monitor. The game depicts a third-person view of four castles. The knights and kings use shields to defend their castle walls from the fireballs that ricochet around the playfield.

Players can capture and catapult the fireballs at opposing castles, using their shield control and "power stone" pushbutton. When a fireball hits a castle wall, it destroys one or more bricks, depending on its speed.

A position not paid for is played by the computer, with a black knight displayed in the appropriate castle. (The upper two castles always have black knights in them.) The computer-controlled knights catapult fireballs at the players with increasing accuracy, to provide challenge.

The game has five possible modes of operation: attract, ready-to-play, play, high score initial, and self-test. Self-test is a special mode for checking the game switches, potentiometers, and computer functions. You may enter this mode at any time. When entered, all game credits are cancelled.

### 1. Attract Mode

The attract mode begins when power is applied to the game, after a play or high score initial mode, or after self-test. This mode is continuous and is only interrupted when a game is paid for and accepted or when you enter self-test.

In this mode, the monitor displays a simulated game of two computer-controlled black knights. A fireball bounces across the playfield, knocking several bricks out of castle walls.

If you select one of the three coined-play settings, the screen shows *GAME OVER/INSERT COINS*, followed by various messages regarding number of coins required for multi-player games. If you set the appropriate option switches for free play, the game displays the message *PRESS PLAYER START*.

Invisible shields move around to protect their respective castle walls. This is why the fireball appears to be deflected from something near the middle of the playfield.

## 2. Ready-to-Play Mode

This mode begins when sufficient coins have been accepted for at least a one-player game. It ends when either player presses a start pushbutton and the subsequent countdown has ended. The countdown lasts about 10 seconds (counting from 9 to 0) and allows another player to insert coins and join the first player.

## 3. Play Mode

The play mode begins when either start button is pressed and the countdown has ended. The mode ends when the last player's castle (containing a crown) has been penetrated by a fireball. At this point a white cloud envelopes the crown, and the latter disappears.

During the countdown a dragon flies back and forth across the screen with a fireball in its mouth. At the end of the countdown, a position activated by a start button has its black knight changed to a king's crown. A position not activated remains as a knight and is controlled by the computer. The dragon then spits the fireball from its mouth toward a player's castle.

The objective is to destroy the three other castles, while protecting one's own castle with the moving shield (potentiometer). The LED pushbuttons have dual functions: in the ready-to-play mode they work as start switches, and during game play they become "power stones" to allow players to capture and catapult fireballs at opponents.

The spinning fireballs released from a shield have more destructive force on a castle wall than a fireball simply deflected from another wall or the sides of the playfield. However, players will soon find out

that they cannot hold onto a fireball for long, since it slowly destroys their own castle walls adjacent to the fireball.

Additional fireballs appear at predetermined intervals or when a castle is destroyed, whichever comes first. A maximum of four fireballs simultaneously appears on the screen.

In one- and two-player games, the players' crowns will be accompanied by a zero, to begin scoring. The point-scoring system is printed on each control panel (the black knights do not earn points).

If the black knight has the surviving castle, the game ends. However, if a player (king) has the surviving castle, that player receives bonus points, all castles are rebuilt, and the game continues with a new battle at a higher "level."

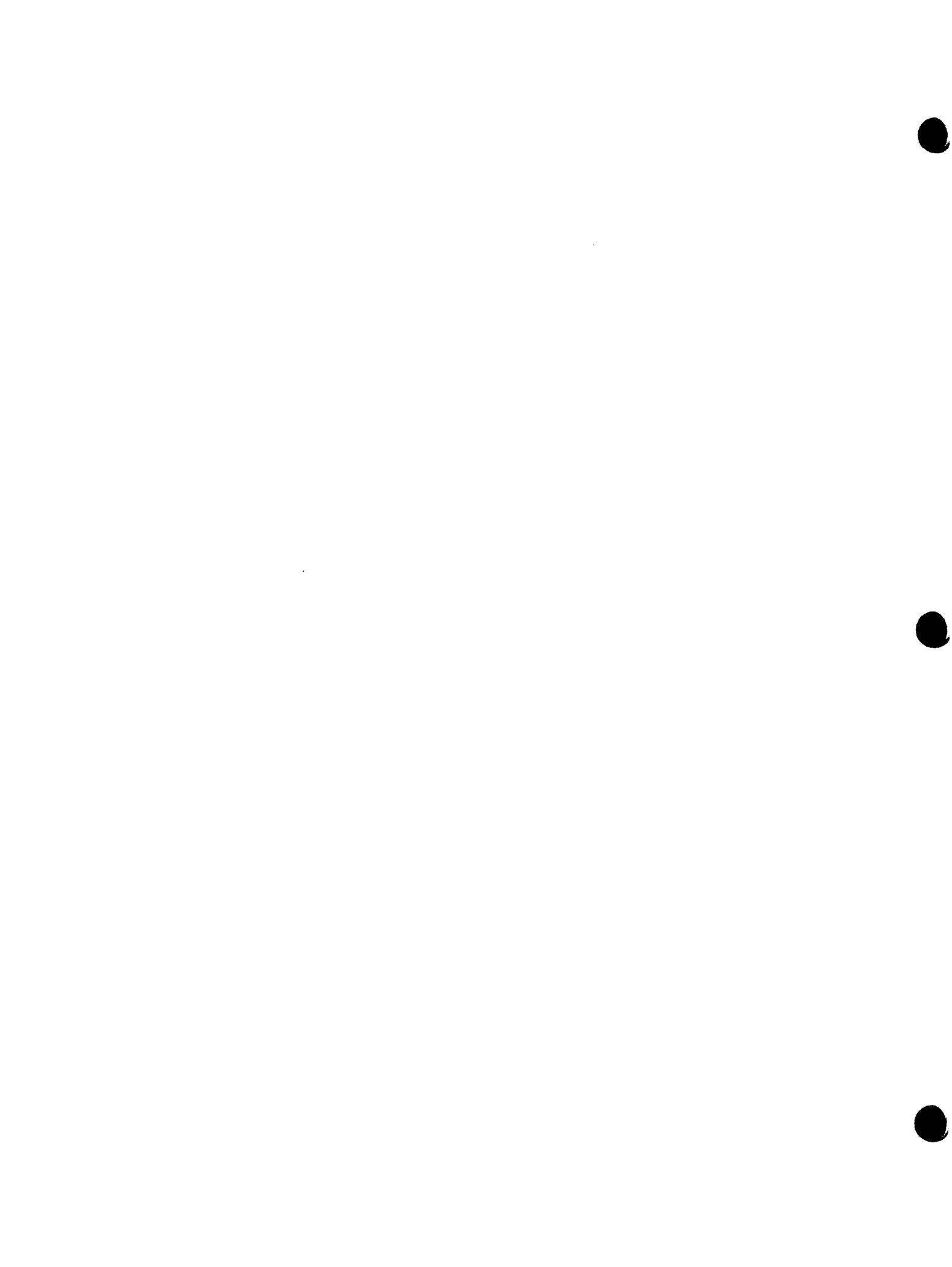
The subsequent levels begin, as mentioned before, with the fireball thrown out by the dragon. In the higher levels black knights play more accurately and faster.

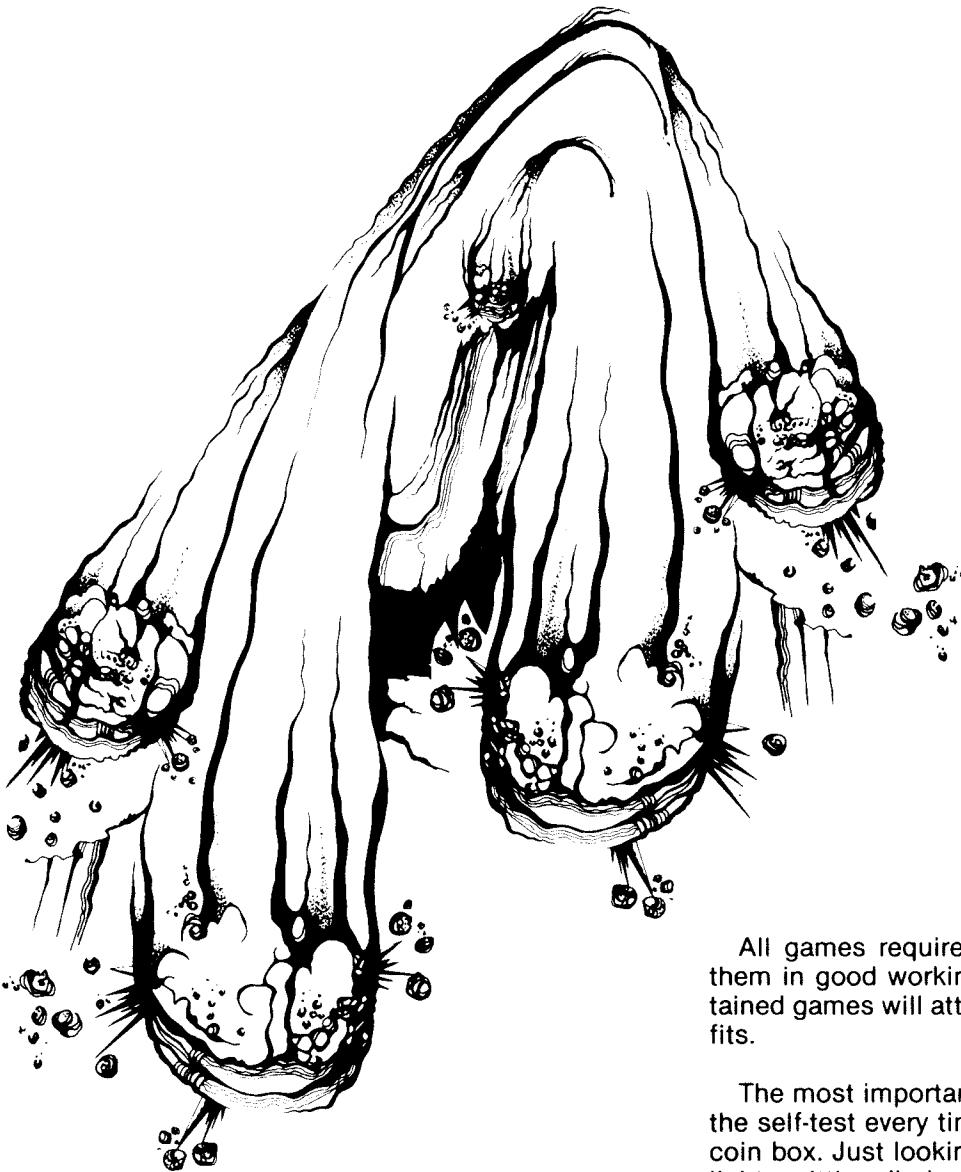
If players abuse the game and activate the slam switch, the computer produces an oscillating high-pitched sound as a warning signal. However, game play is not interrupted.

## 4. High Score Initial Mode

If one or more players have achieved the highest score currently in the memory, they can enter their initials. Turning the shield-control knob will change the letters, and pressing the start button will enter the selected initial. Up to three letters will be displayed next to the individual or team high score during the attract mode.







All games require certain maintenance to keep them in good working order. Clean, properly maintained games will attract players and earn more profits.

The most important maintenance item is running the self-test every time you collect money from the coin box. Just looking at a game will not tell you if light-emitting-diode switches or potentiometers are broken, or if LEDs have burned out. The self-test will inform you of any of these possible problems.

Second, you should regularly clean the outside of the game and the coin mechanisms.

# Maintenance and Repair



## A. Cleaning

The exterior of the game cabinet and the metal and acrylic surfaces may be cleaned with any non-abrasive household cleaner. If desired, special coin machine cleaners that leave no residue can be obtained from your distributor. **Do not** dry-wipe any of the acrylic panels, because any dust can scratch the surface and result in fogging the plastic.

## B. Fuse Replacement

This game contains six fuses—all on the power supply assembly (not including the monitor fuses). Replace fuses only with the same type as listed in Figure 20 of this manual. See the monitor manual, TM-125, for the monitor fuse data.

## C. Opening the Control Panel

Prior to replacing any player control on the control panel, unplug the game. Then open the coin door.

Reach through the opening and remove both sets of carriage bolts, wing nuts, split lock washers, and large flat washers, located on the underside of the control panel (see Figure 10).

Lift up on the control panel and tilt it towards you. **Be sure that the acrylic monitor shield does not fall on you.** The top edge of the control panel acts as a

retainer strip for the shield: once the control panel is opened, the shield is free and could slide out under its own power.

### 1. LED Switch Replacement

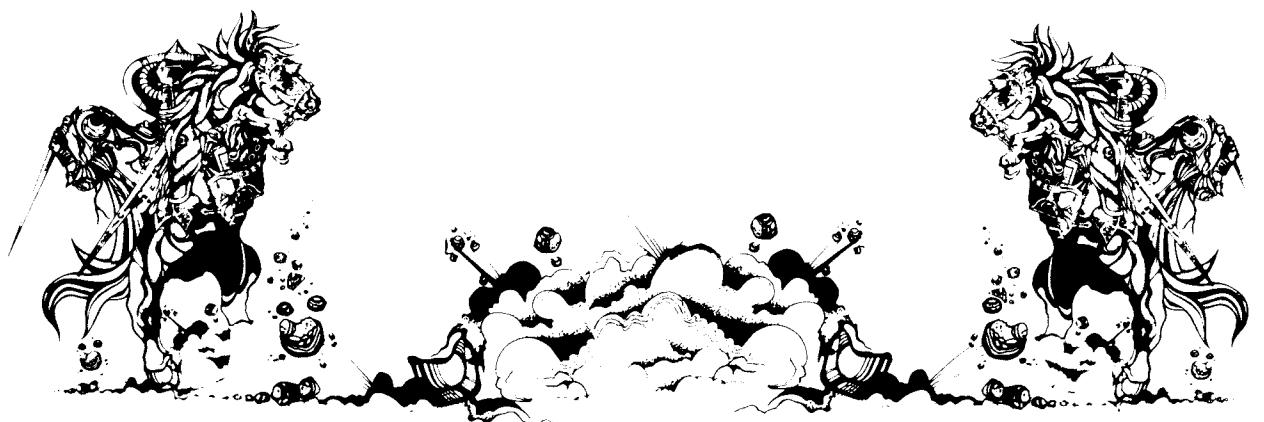
The light-emitting diode (LED) switches on the control panel have a very low failure rate. In case a switch should ever be suspect, first test it per the description that follows. To replace the switch, refer to Figure 10.

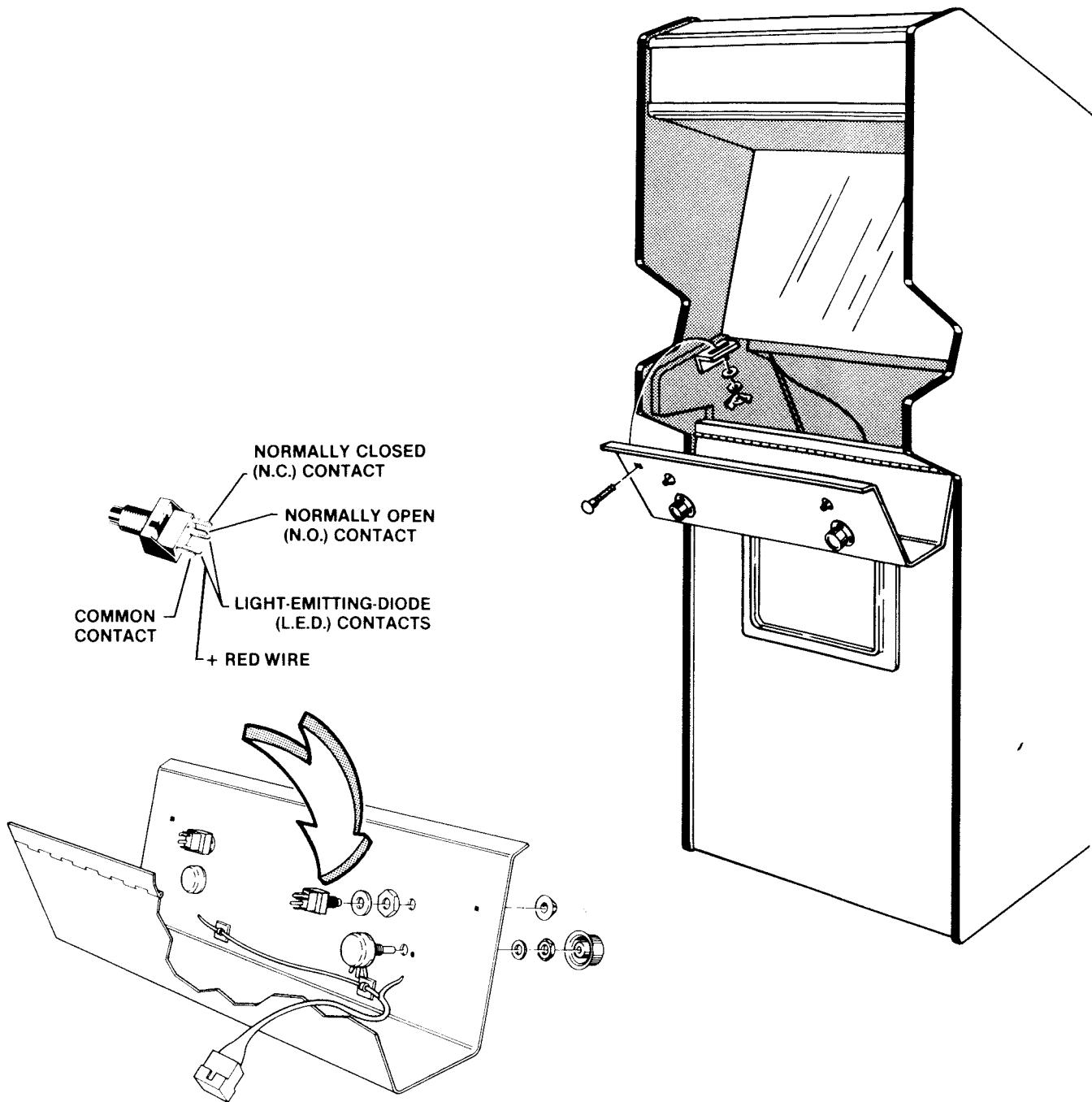
- Remove the wires from the suspected switch.
- Set multimeter to ohms scale. Set ohms scale to  $R \times 1$ , then zero the meter.
- Connect multimeter leads to appropriate LED switch contacts (see Figure 10 for designation of switch contacts and meter lead placement).
- Check contacts (push and release the switch button) for closed and open continuity.
- If the contacts do not operate sharply or always remain closed or open, then replace the LED switch as outlined in the figure.

### 2. Potentiometer Replacement

Remove the wires from the faulty potentiometer. Using a 5/64-inch Allen wrench, loosen both set screws on the side of the shield control knob; remove this knob. Next remove the flat hex nut on the outside of the panel with a wrench. Then remove the internal-tooth lock washer.

Replace the potentiometer with a new one, making sure the hex nut and knob are tightened securely. Then reconnect the three harness wires.





**To remove LED switch:**

- Remove all wires from the faulty switch.
- Turn the switch counterclockwise while holding the black cone-shaped nut on the outside of the control panel.
- Install a new switch using the reverse procedure.
- Reconnect the harness wires.

**Figure 10 Opening the Control Panel and Replacing Player Controls**

## D. Monitor Removal

### **WARNING**

#### **Shock Hazard**

High voltages may exist in any television or monitor, even with power disconnected. Use extreme caution and do not touch electrical parts of the yoke area with your hands or with metal objects in your hands!

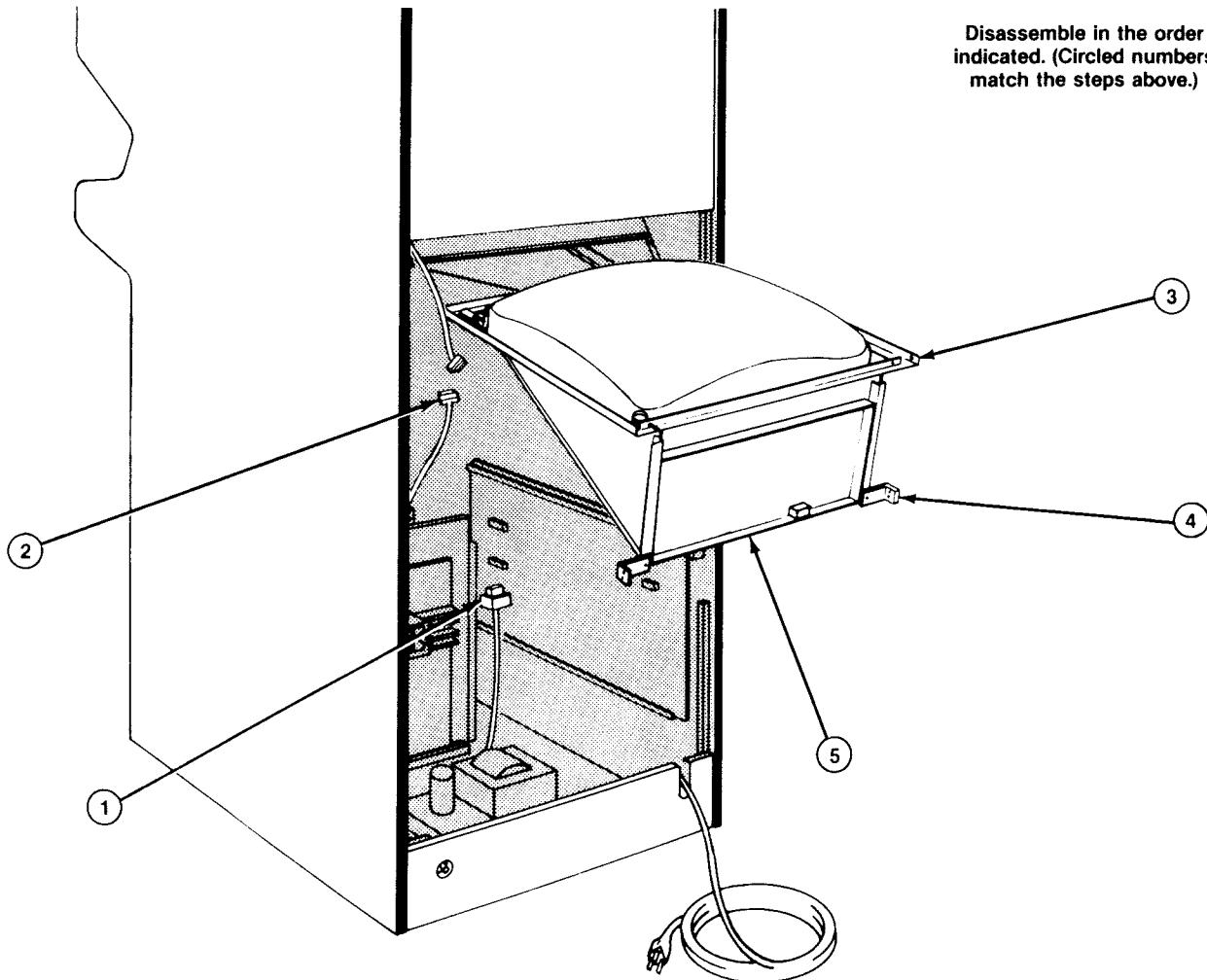
#### **Implosion Hazard**

If you drop the monitor and the picture tube breaks, it **will implode!** Shattered glass and the yoke can fly 6 feet or more from the implosion. Use care when replacing any monitor.

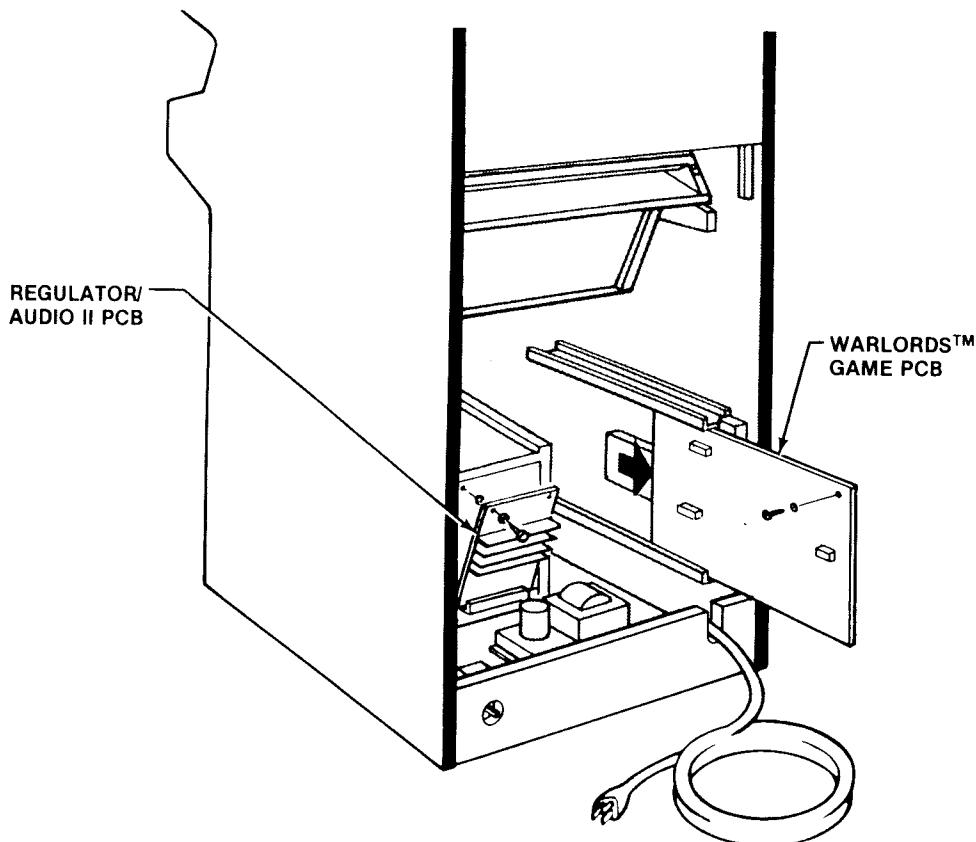
If you should need to remove the monitor, follow steps 1 thru 4 that follow. Refer also to Figure 11.

1. **Unplug the game from its wall outlet!** Open the rear access panel. Reach in the opening and unplug the 12-pin harness connector at the bottom (rear) of the monitor chassis.
2. Unplug the 5-pin harness connector located at the center left side of the access panel opening.
3. Remove the two screws that hold rear of the monitor frame to the cabinet walls.
4. Locate the two black "L" brackets that hold the rear of the monitor to the cabinet walls. Remove the four screws that secure these brackets to the cabinet.
5. Slightly lift up the monitor chassis, and slide it out the rear of the game. You might have to slightly bend the bottom rear flap of the large cardboard bezel.

Disassemble in the order indicated. (Circled numbers match the steps above.)



**Figure 11 Monitor Removal**



**Figure 12 Printed-Circuit Board Removal**

## E. Printed-Circuit Board Removal

You may wish to remove the game printed-circuit board (PCB) or the Regulator/Audio II PCB for service or inspection. To do this, refer to Figure 12 and proceed as follows:

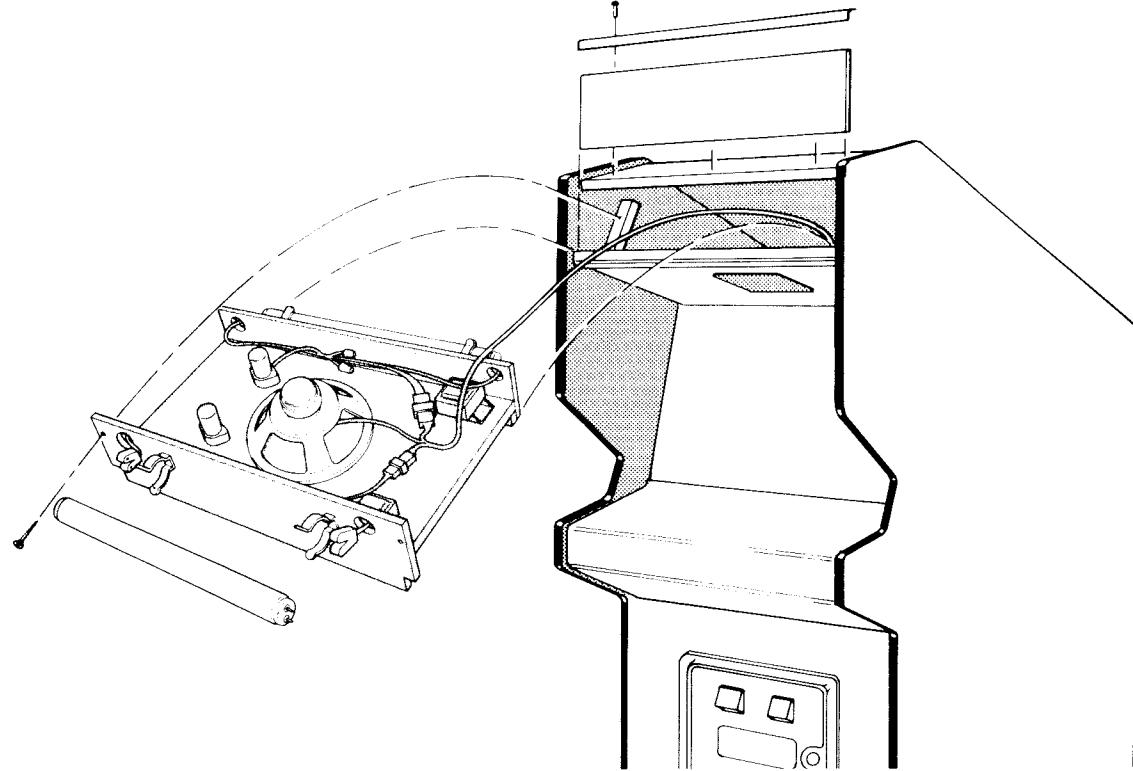
### 1. Game PCB Removal

- Open the rear access panel.
- Remove the two beaded nylon tie wraps from the PCB's edge connector. Remove the 44-pin edge connector from the right side of PCB.
- Locate the Phillips-head screw that extends through the PCB and into the wood block (at the right side of the board). Remove and save this screw as well as the fiber washer.
- Remove the PCB from the cabinet by carefully sliding it straight out of the plastic PCB retainer. Be careful not to twist the board, as this may loosen connections or components. Replace or repair as required.

- After servicing it, reinstall the PCB, making sure that the 44-pin edge connector is properly plugged in. Note that the connector is keyed to fit on only one way, so if it doesn't slip on easily, don't force it! **A reversed connector will probably damage your game and will void the warranty.**
- Check that the operation of the game is correct by **performing the self-test**. This is especially important with any game when you replace a PCB.

### 2. Regulator/Audio II PCB Removal

- Unlock and open the access panel.
- Remove the five plug-in connectors on the Regulator/Audio II PCB. Note that all of these connectors are keyed for proper orientation.
- Locate the two Phillips-head screws that extend through the PCB and into the wood behind the PCB. Remove and save these two screws and the two fiber washers.
- Remove the PCB from the interior wall of the cabinet.



**Figure 13 Fluorescent Tube Replacement**

## F. Fluorescent Light and Speaker Replacement

### ▲ WARNING ▲

If you drop a fluorescent tube and it breaks, **it will implode!** Shattered glass can fly 6 feet or more from the implosion. Use care when replacing any fluorescent tube.

Avoid looking at the blacklight when it is on. It may damage your eyes.

To replace the fluorescent white- or blacklight tube behind the front graphics attraction panel, follow this procedure (see Figure 13):

1. Remove the three Allen-head screws and lock washers at the top of the game (they secure the black metal retainer for the attraction panel). Lift the attraction panel up and out of its lower retainer.

2. If you need to replace the **blacklight** tube, remove the two Phillips screws that secure the light board to the cabinet, and slide out the whole assembly. The harness has plenty of length, so you can pull the assembly about two feet out of the game.
3. Remove the two Y-shaped connectors from the ends of the fluorescent tube: you may find it helpful to use a flat-head screwdriver. Now carefully remove the tube from its clamps by pulling it towards you.
4. Replace with a new tube. Do not snap the tube in vigorously—you **may break it, causing an implosion!**
5. Reconnect the Y-shaped connectors. Reinstall the fluorescent light assembly with the two screws (if you removed it). Replace the attraction panel on the front of the game. When tightening the Allen screws, be sure the top retainer strip is pushed tightly back against the attraction panel.

## G. Game Operation

With this manual you received two large sheets that contain the wiring and schematic diagrams for the Warlords™/upright game. Sheet 1, Side A, includes a "table of contents" that shows the arrangement of these diagrams. They include explanations of the functions of the circuits; the diagrams also define inputs and outputs.

Atari's Warlords™ is a microprocessor-controlled game. The microprocessor is contained on the game PCB. The game PCB receives switch inputs from the control panel and coin door. These inputs are processed by the game PCB and output to the monitor, Regulator/Audio II PCB, loudspeaker, coin counter, and control panel.

The Regulator/Audio II PCB performs two functions: 1) it regulates the + 10.3 VDC from the power supply to + 5 VDC, and 2) it amplifies the audio output from the game PCB. The + 5 VDC from the Regulator/Audio II PCB provides most logic power to the game PCB. The audio output from the Regulator/Audio II PCB directly drives the game speaker and is controlled by the volume control, mounted inside the coin door.

The power supply is the source of all voltages in the game. These voltages are protected by four fuses (F3 thru F5) on the power supply chassis. The primary winding of the power supply transformer is protected by the fuses F1 and F2 on the power supply chassis.

Figure 14 illustrates the distribution of power in this game. Figure 15 illustrates the distribution of signals.



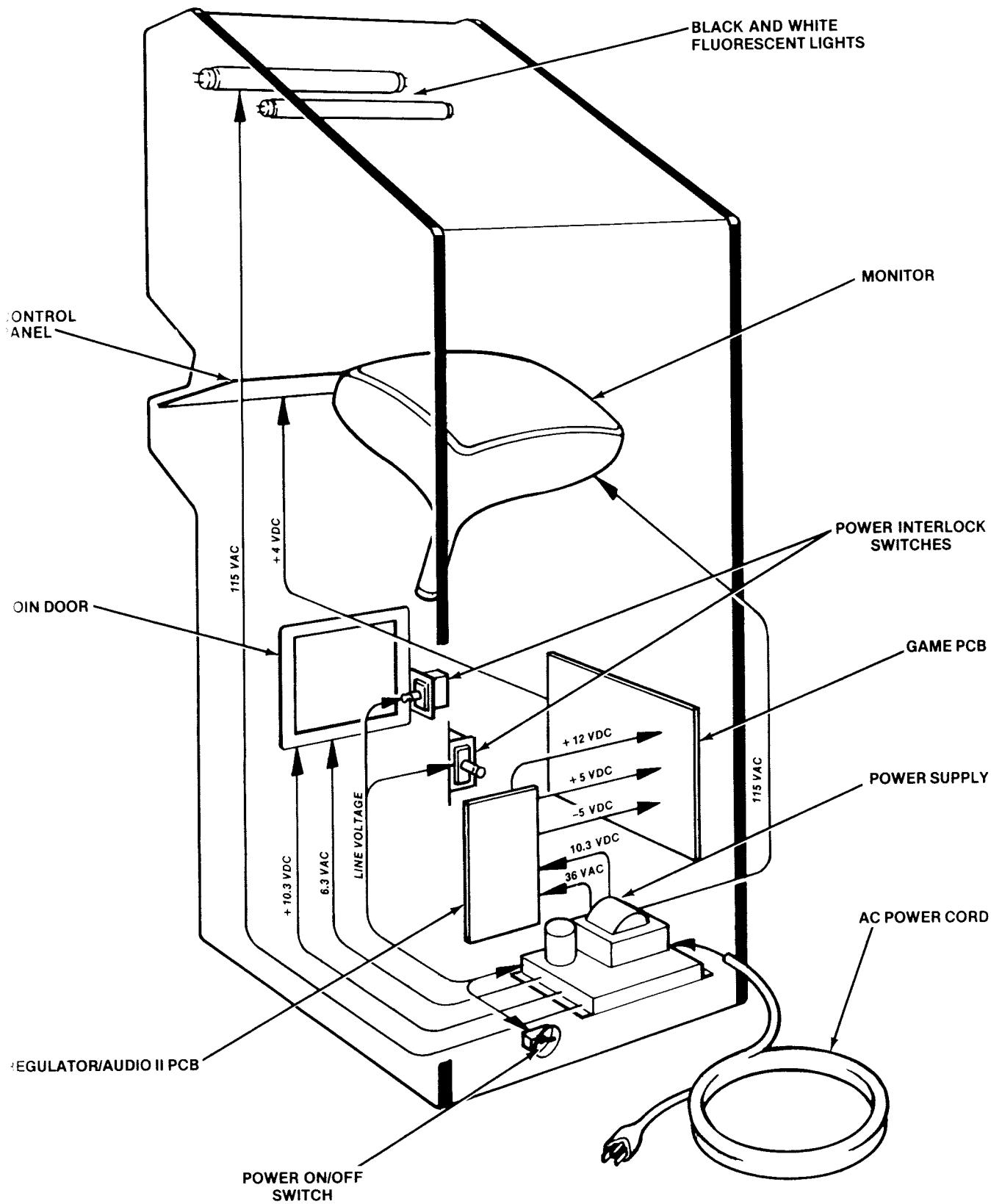


Figure 14 Power Distribution

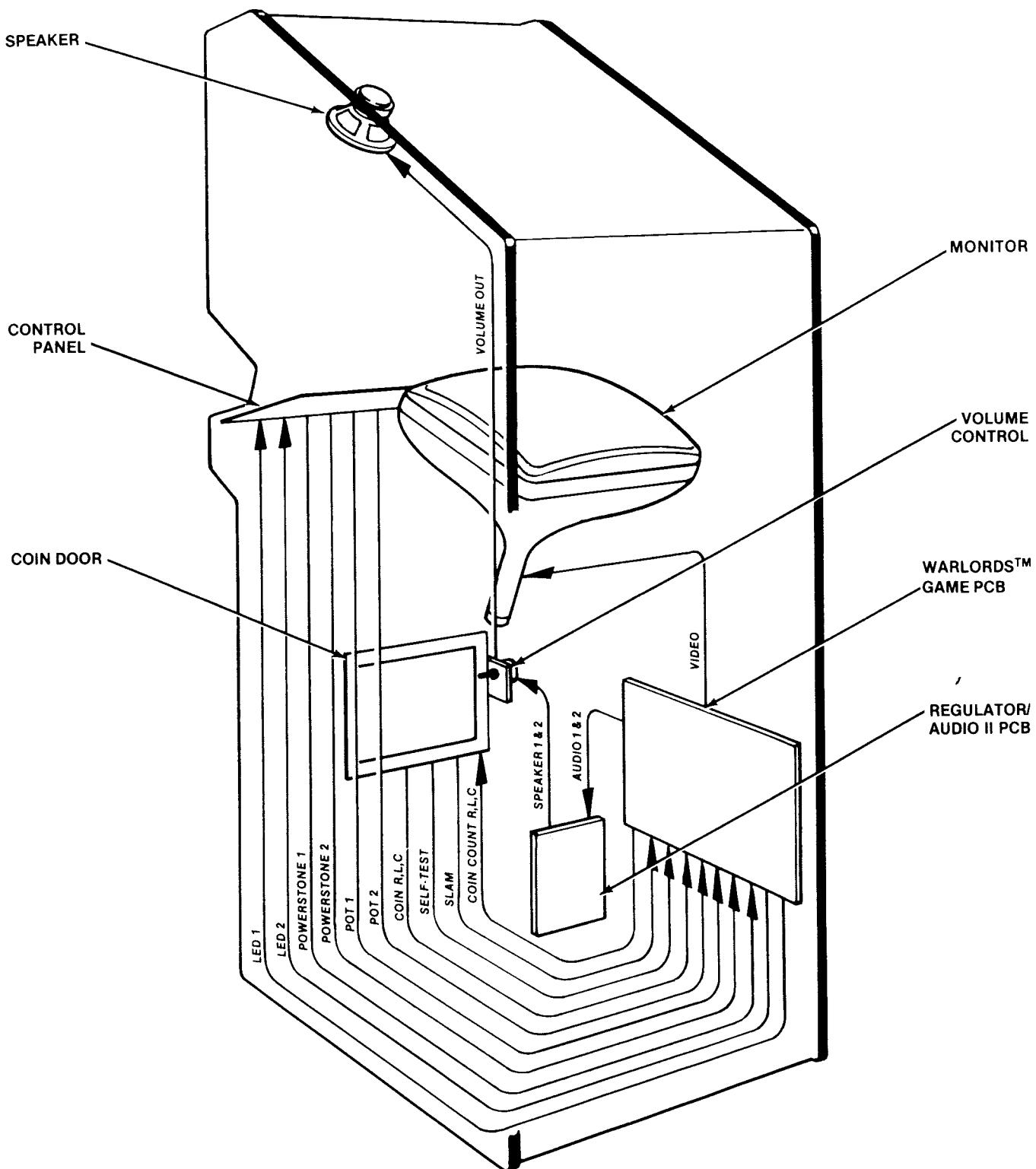
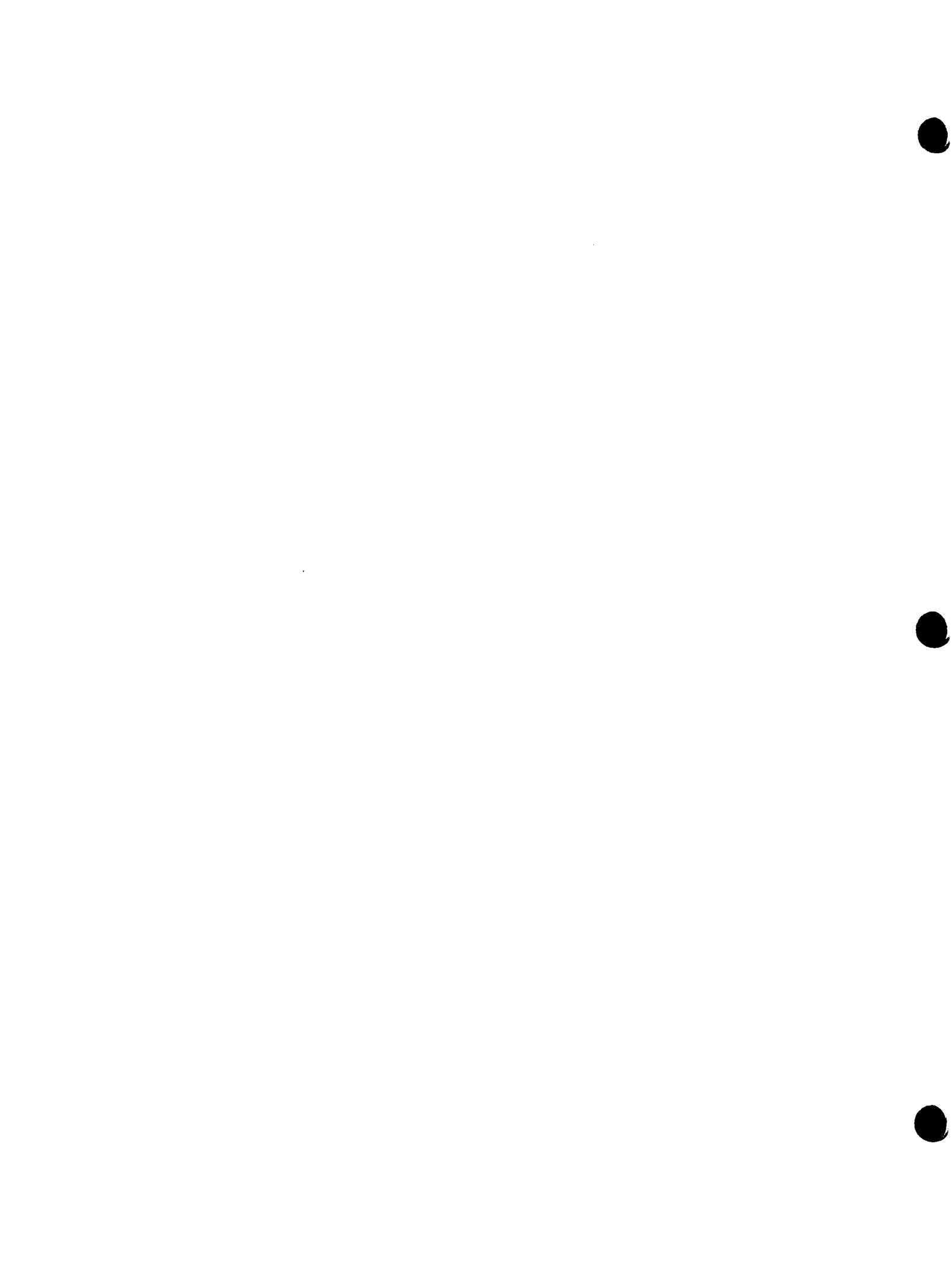
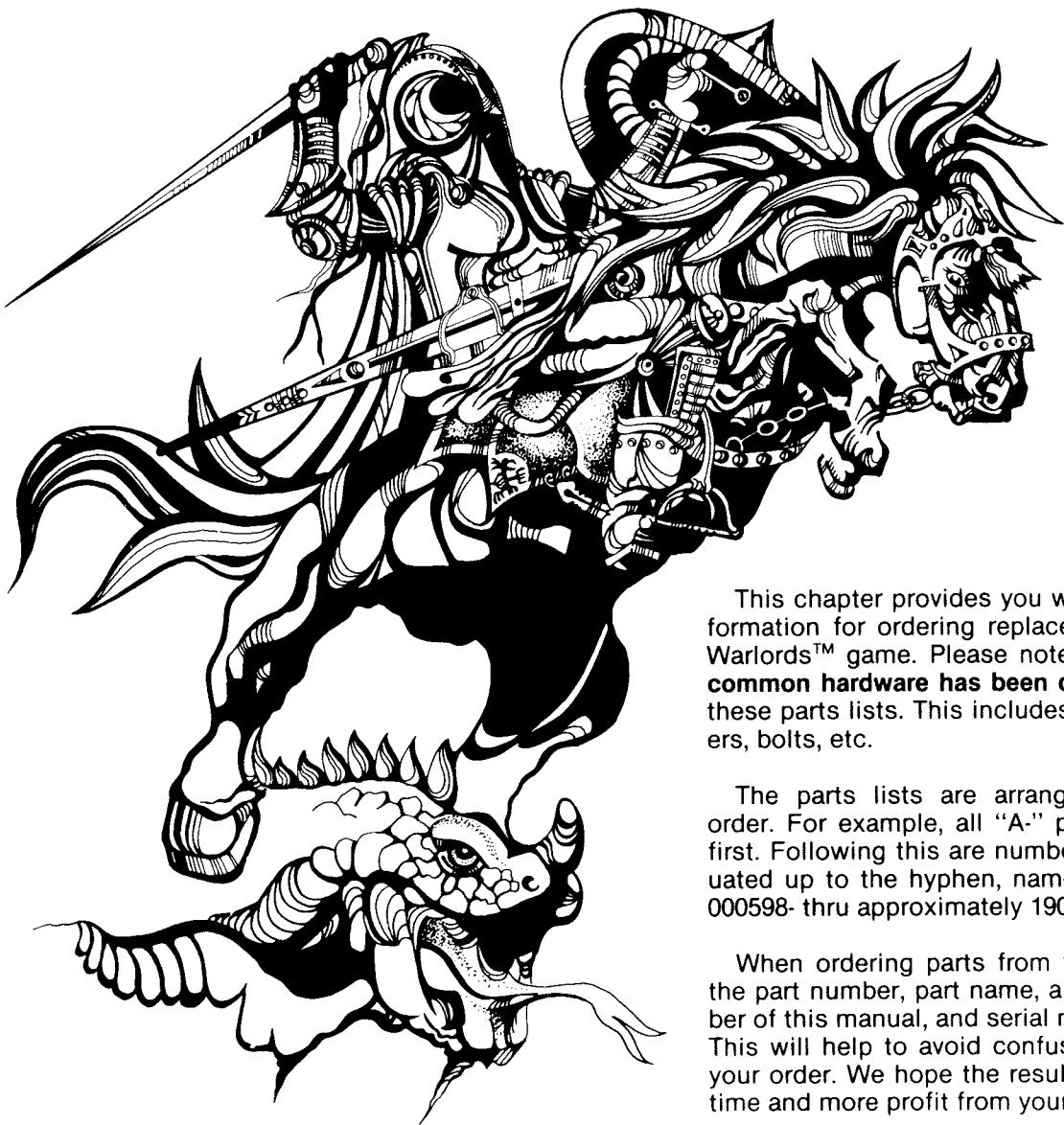


Figure 15 Signal Distribution



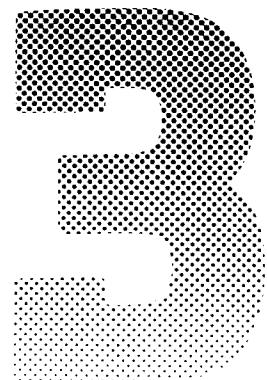


This chapter provides you with the necessary information for ordering replacement parts for your Warlords™ game. Please note that, for simplicity, **common hardware has been deleted** from most of these parts lists. This includes screws, nuts, washers, bolts, etc.

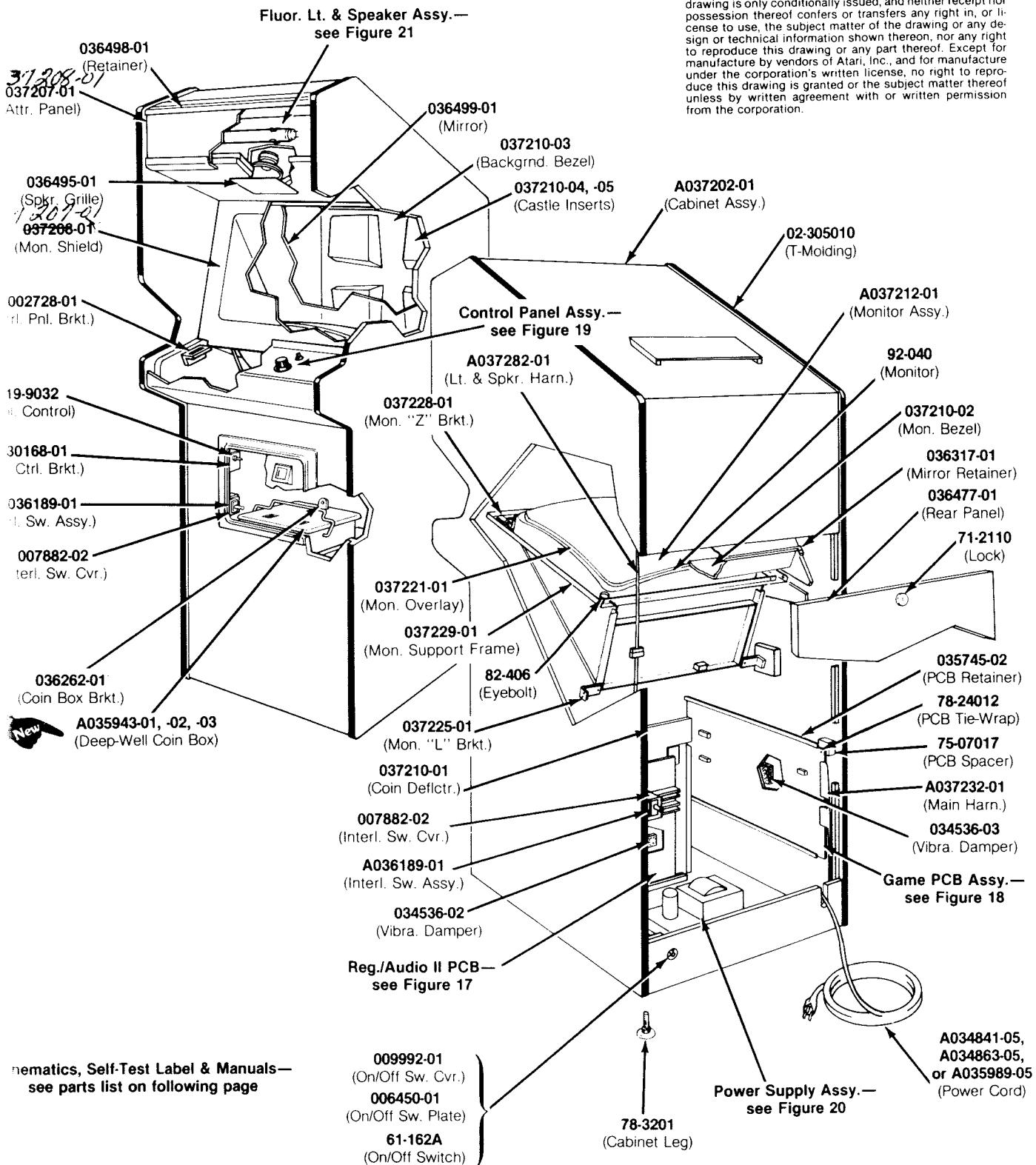
The parts lists are arranged in alphanumeric order. For example, all "A-" prefix numbers come first. Following this are numbers in sequence evaluated up to the hyphen, namely 00- thru 99-, then 000598- thru approximately 190000-.

When ordering parts from your distributor, give the part number, part name, applicable figure number of this manual, and serial number of your game. This will help to avoid confusion and mistakes in your order. We hope the results will be less down-time and more profit from your game.

# Illustrated Parts Lists



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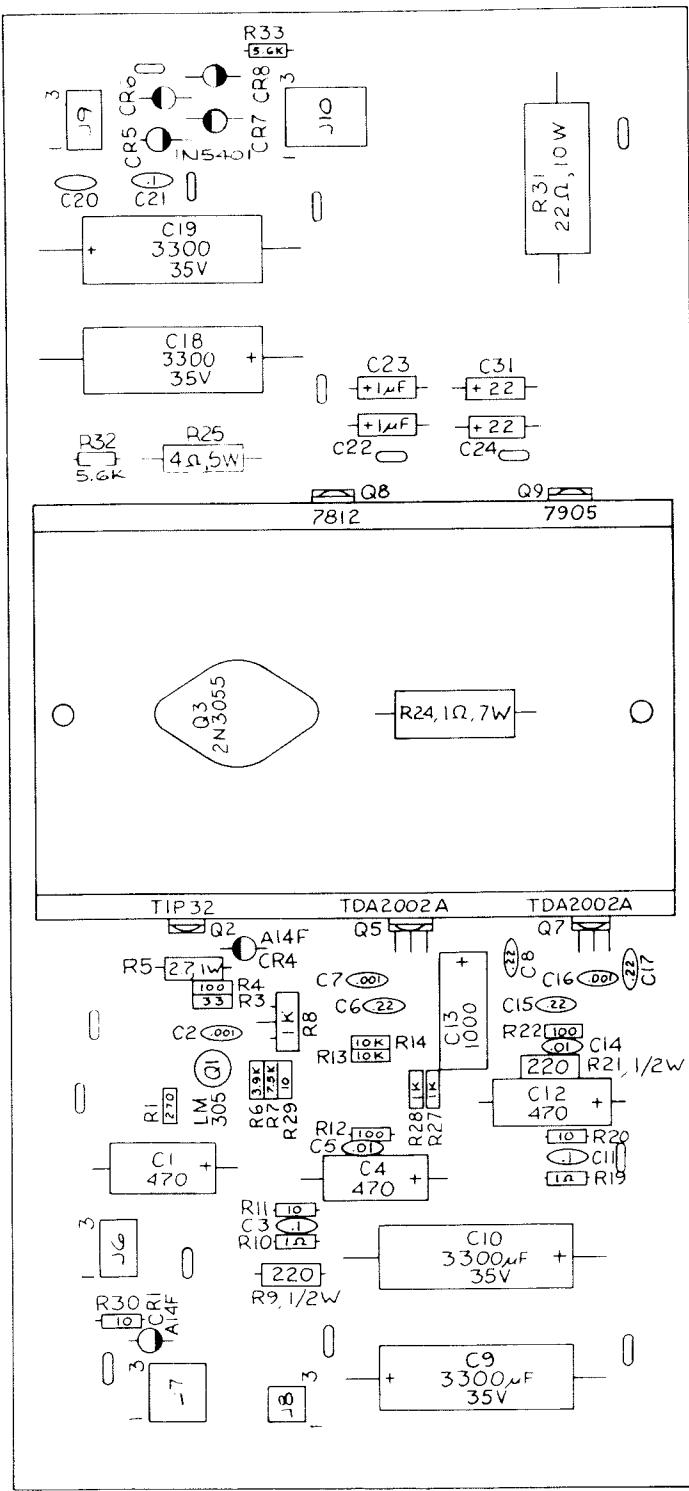


## **Figure 16 Cabinet-Mounted Assemblies**

## Figure 16 Cabinet-Mounted Assemblies, continued Parts List

| Part No.  | Description   |
|---|---|
| A034841-05  | U.S. Strain-Relief Power Cord   |
| A034863-05  | German Strain-Relief Power Cord   |
| A035943-01  | Deep-Well Coin Box Assembly <i>(for all the same coins)</i>   |
| A035943-02  | Deep-Well Coin Box Assembly <i>(for two different coin denominations—has one separator)</i>                     |
| A035943-03  | Deep-Well Coin Box Assembly <i>(for three different coin denominations—has two separators)</i>                  |
| A035989-05  | Australian Strain-Relief Power Cord   |
| A036189-01  | Interlock Switch/Bracket Assembly <i>(modified for safety)</i>  |
| A037202-01  | Wood Cabinet Assembly <i>(includes legs and PCB retainers)</i>  |
| A037212-01  | Monitor Assembly <i>(includes frame, brackets, eyebolts and all common hardware)</i>                            |
| A037232-01  | Main Harness Assembly   |
| A037282-01  | Light and Speaker Harness Assembly <i>(at upper rear of game)</i>   |
| <i>The following five items are the technical information supplements to this game:</i> |   |
| DP-175-01   | Warlords™/Upright Schematic Drawings <i>(Sheet 1)</i>   |
| DP-175-02   | Warlords/Upright Schematic Drawings <i>(Sheet 2)</i>  |
| ST-175  | Label with Self-Test Procedure and Option Switch Settings   |
| TM-125  | Technical Manual for 19- and 23-Inch Wells-Gardner Raster-Scan Monitors   |
| TM-175  | Warlords/Upright Operation, Maintenance and Service Manual  |
| 02-305010   | 3/4-Inch Black Plastic T-Molding  |
| 19-9032   | 50-Ohm, 12½-Watt, Wirewound Rheostat <i>(volume control)</i>  |
| 61-162A   | DPST Power On/Off Toggle Switch   |
| 71-2110   | Panel Cartridge Lock Mechanism <i>(for rear access panel)</i>   |
| 75-07017  | Spacer for Mounting Printed-Circuit Boards  |
| 78-24012  | 5-Inch Beaded Nylon Tie-Wrap <i>(for Game PCB edge connector)</i>   |
| 78-3201   | Cabinet-Leveling Leg  |
| 82-406  | #1/4-20 Machine-Thread Eyebolt, 2 inches long overall <i>(for mounting monitor to frame)</i>                    |
| 92-040  | Wells-Gardner 23-Inch Monochrome Raster-Scan Monitor  |
| 002728-01   | Control Panel Mounting Bracket  |
| 006450-01   | On/Off Switch Mounting Plate  |
| 007882-02   | Interlock Switch Cover  |
| 009992-01   | On/Off Switch Cover   |
| 030168-01   | Volume Control Mounting Bracket   |
| 034536-02   | ½-Inch-Thick Foam Vibration Damper <i>(for Regulator/Audio II PCB)</i>  |
| 034536-03   | 1 1/8-Inch-Thick Foam Vibration Damper <i>(for Game PCB)</i>  |
| 035745-02   | 18-Inch Plastic PCB Retainer  |
| 035942-01   | Deep-Well Coin Box Separator  |
| 036262-01   | Coin Box Bracket  |
| 036317-01   | Mirror Retainer   |
| 036477-01   | Rear Access Panel <i>(does not include lock)</i>  |
| 036495-01   | Speaker Grille  |
| 036498-01   | Retainer for Attraction Panel   |
| 036499-01   | Half-Silvered (Semi-Transparent) Mirror   |
| 036686-01   | Sheet of Game Pricing Labels  |
| 037207-01   | Attraction Panel with Graphics  |
| 037208-01   | Monitor Shield with Graphics  |
| 037210-01   | Cardboard Coin Deflector  |
| 037210-02   | Cardboard Monitor Bezel   |
| 037210-03   | Cardboard Background Bezel  |
| 037210-04   | Cardboard Castle Insert   |
| 037210-05   | Cardboard Castle Insert <i>(If replacing these inserts, note that all castle doors should face the bridges)</i> |
| 037221-01   | Monitor Overlay with Graphics   |
| 037225-01   | Monitor Support "L" Bracket <i>(at rear two corners of chassis)</i>   |
| 037228-01   | Monitor Support "Z" Bracket <i>(at top two corners of screen)</i>   |
| 037229-01   | Steel Monitor Support Frame   |

New



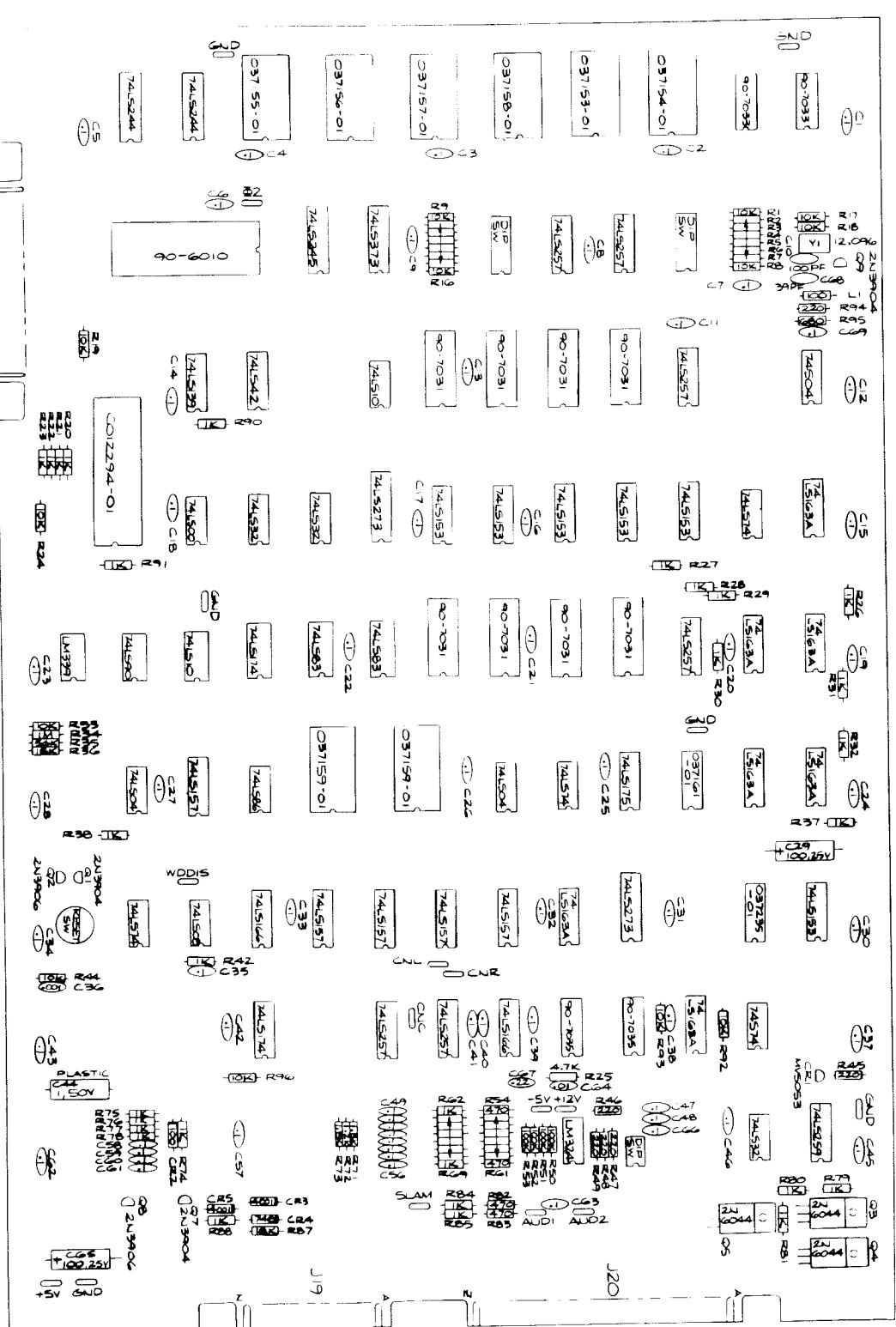
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**Figure 17 Regulator/Audio II PCB Assembly  
D A035435-02**

## Figure 17 Regulator/Audio II PCB Assembly Parts List

| <i>Part No.</i> | <i>Description (Reference Designations and Locations in Bold)</i>                      |
|-----------------|--|
| 12-52P7         | 2.7 Ohm, ± 5%, 1W Resistor ( <b>R5</b> )   |
| 16-54PO         | 4 Ohm, ± 5%, 5W Wirewound Resistor ( <b>R25</b> )                                      |
| 19-100P1015     | .1 Ohm, ± 3%, 7W Wirewound Resistor ( <b>R24</b> )                                     |
| 19-315102       | 1K Ohm Vertical PCB-Mounting Cermet Trimpot ( <b>R8</b> )                              |
| 24-250108       | 1000 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor ( <b>C13</b> )            |
| 24-250477       | 470 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor ( <b>C1, 4, 12</b> )       |
| 24-350226       | 22 uf Aluminum Electrolytic Fixed Axial-Lead 35V Capacitor ( <b>C24, 31</b> )          |
| 24-350338       | 3300 uf Aluminum Electrolytic Fixed Axial-Lead 35V Capacitor ( <b>C9, 10, 18, 19</b> ) |
| 24-500105       | 1 uf Aluminum Electrolytic Fixed Axial-Lead 50V Capacitor ( <b>C22, 23</b> )           |
| 29-088          | .1 uf Ceramic-Disc 25V Radial-Lead Capacitor ( <b>C3, 11, 20, 21</b> )                 |
| 31-1N4002       | 100V 1-Amp. Silicon Rectifier Type 1N4002 Diode ( <b>CR1, 4-8</b> )                    |
| 31-5401         | 100V 3-Amp. Silicon Rectifier Type 1N5401 Diode ( <b>CR 5-8</b> )                      |
| 33-TIP32        | PNP Power Transistor, Type TIP32 ( <b>Q2</b> )   |
| 34-2N3055       | NPN Silicon Transistor, Type 2N3055 ( <b>Q3</b> )                                      |
| 37-LM305        | 5V Linear Voltage Regulator ( <b>Q1</b> )  |
| 37-7812         | + 12V Voltage Regulator, Type 7812 ( <b>Q8</b> )                                       |
| 37-7905         | – 5V Voltage Regulator, Type 7905 ( <b>Q9</b> )  |
| 72-1608C        | #6-32 x 1/2-Inch Cross-Recessed Pan-Head Corrosion-Resistant Steel Machine Screw       |
| 75-F60405       | #6-32 x 1/4-Inch Binder-Head Nylon Screw   |
| 75-99516        | #6-32 Nut/Washer Assembly  |
| 78-16008        | Thermally Conductive Compound ( <b>Q3</b> )  |
| 78-16014        | Thermally Conductive Silicon Insulator ( <b>Q2, 9</b> )                                |
| 79-58306        | 6-Position Connector Receptacle ( <b>J6, 9</b> )                                       |
| 79-58308        | 9-Position Connector Receptacle ( <b>J7</b> )  |
| 79-58346        | 12-Position Connector Receptacle ( <b>J10</b> )  |
| 79-58354        | 4-Position Connector Receptacle ( <b>J8</b> )  |
| 020670-01       | Test Point   |
| 034531-01       | Heat Sink  |
| 100015-103      | .01 uf Ceramic-Disc 25V Radial-Lead Capacitor ( <b>C5, C14</b> )                       |
| 110000-010      | 1 Ohm, ± 5%, 1/4W Resistor ( <b>R10, 19</b> )  |
| 110000-100      | 10 Ohm, ± 5%, 1/4W Resistor ( <b>R11, 20, 29, 30</b> )                                 |
| 110000-101      | 100 Ohm, ± 5%, 1/4W Resistor ( <b>R4, 12, 22</b> )                                     |
| 110000-102      | 1K Ohm, ± 5%, 1/4W Resistor ( <b>R27, 28</b> )   |
| 110000-103      | 10K Ohm, ± 5%, 1/4W Resistor ( <b>R13, 14</b> )  |
| 110000-271      | 270 Ohm, ± 5%, 1/4W Resistor ( <b>R1</b> )   |
| 110000-330      | 33 Ohm, ± 5%, 1/4W Resistor ( <b>R3</b> )  |
| 110000-392      | 3.9K Ohm, ± 5%, 1/4W Resistor ( <b>R6</b> )  |
| 110000-562      | 5.6K Ohm, ± 5%, 1/4W Resistor ( <b>R32, 33</b> )                                       |
| 110000-752      | 7.5K Ohm, ± 5%, 1/4W Resistor ( <b>R7</b> )  |
| 110001-221      | 220 Ohm, ± 5%, 1/2W Resistor ( <b>R9, 21</b> )   |
| 116000-220      | 22 Ohm, ± 5%, 10W Wirewound Resistor ( <b>R31</b> )                                    |
| 122002-102      | .001 uf Ceramic-Disc Minimum 25V Radial-Lead Capacitor ( <b>C2, 7, 16</b> )            |
| 122004-224      | .22 uf Ceramic-Disc 25V Capacitor ( <b>C6, 8, 15, 17</b> )                             |
| 137151-002      | Type TDA2002A 8W Linear Audio Amplifier Integrated Circuit ( <b>Q5, 7</b> )            |

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**Figure 18 Warlords™ Game PCB Assembly  
A036434-01 and -02 B**

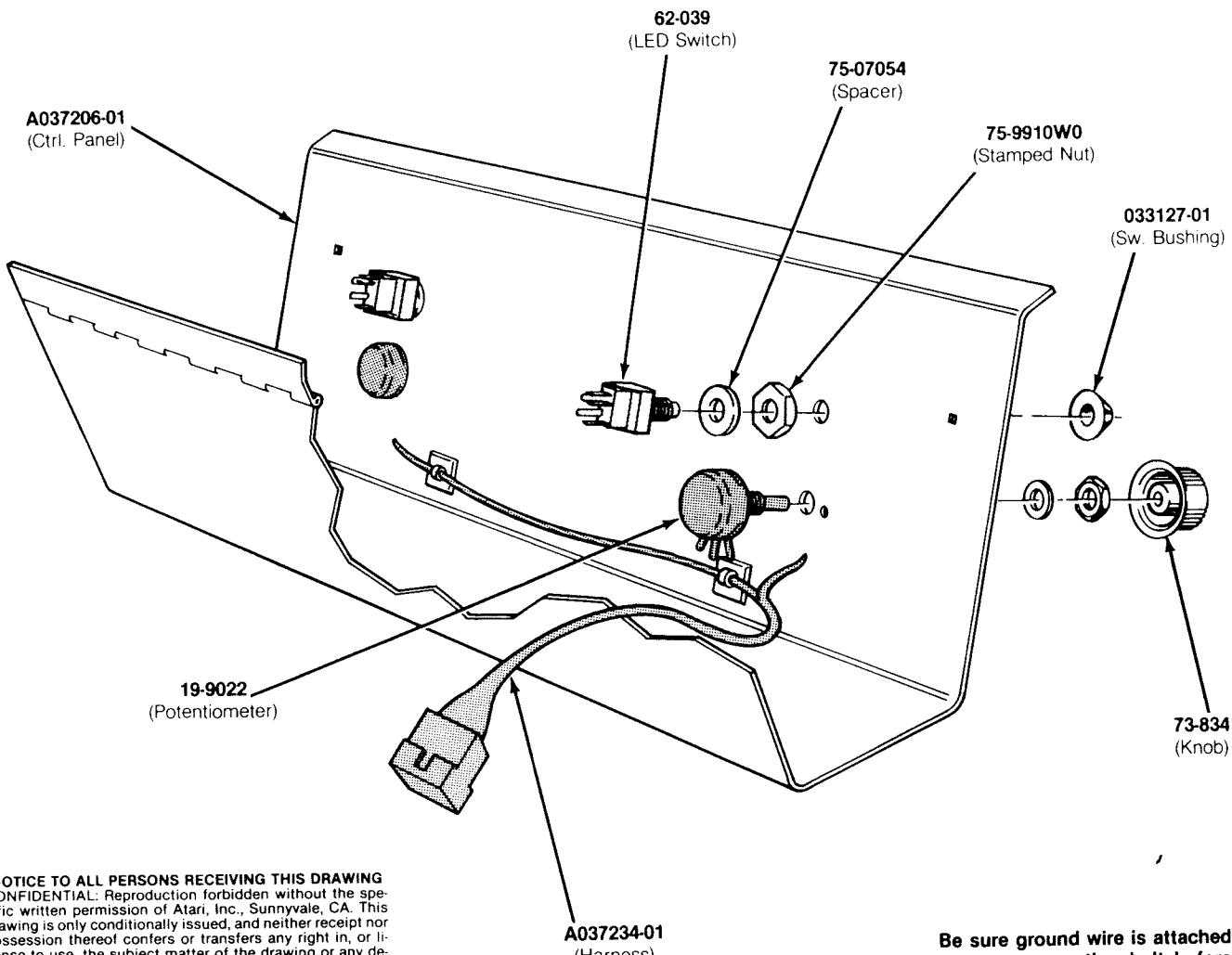
**Figure 18 Warlords™ Game PCB Assembly, continued  
Parts List**

| Part No.    | Description (Reference Designations and Locations in Bold)  |
|-------------|---|
| C012294-01  | Audio I/O N-Channel MOS/LSI Custom Chip ( <b>B3/4</b> )   |
| 24-250107   | 100 uf Aluminum Electrolytic Fixed Axial-Lead 25V Capacitor ( <b>C29, 65</b> )                                |
| 28-101101   | 100 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor ( <b>C10</b> )  |
| 28-101390   | 39 pf Radial-Lead Epoxy-Dipped 100V Mica Capacitor ( <b>C68</b> )   |
| 29-088      | .1 uf Ceramic-Disc 25V Radial-Lead Capacitor ( <b>C1-9, 11-28, 30-35, 37-43, 45-63, 66, 69</b> )              |
| 31-1N100    | 100V Type-1N100 Switching Diode ( <b>CR2</b> )  |
| 31-1N4001   | 75V Type-1N4001 Switching Diode ( <b>CR3, 5</b> )   |
| 33-2N3906   | Type-2N3906 PNP Switching and Amplifying Transistor ( <b>Q2, 8</b> )  |
| 34-2N3904   | Type-2N3904 NPN Silicon Transistor ( <b>Q1, 7, 9</b> )  |
| 34-2N6044   | Type-2N6044 Darlington NPN Transistor ( <b>Q3-5</b> )   |
| 37-LM324    | Type-LM324 Integrated Circuit ( <b>K9</b> )   |
| 37-LM339    | Type-LS339 Integrated Circuit ( <b>A5</b> )   |
| 37-74LS00   | Type-74LS00 Integrated Circuit ( <b>C4</b> )  |
| 37-74LS04   | Type-74LS04 Integrated Circuit ( <b>B6, J6</b> )  |
| 37-74LS08   | Type-74LS08 Integrated Circuit ( <b>C7</b> )  |
| 37-74LS10   | Type-74LS10 Integrated Circuit ( <b>C5, F3</b> )  |
| 37-74LS32   | Type-74LS32 Integrated Circuit ( <b>D4, E4, N9</b> )  |
| 37-74LS42   | Type-74LS42 Integrated Circuit ( <b>D3</b> )  |
| 37-74LS74   | Type-74LS74 Integrated Circuit ( <b>N4, K6, B7</b> )  |
| 37-74LS83   | Type-74LS83 Integrated Circuit ( <b>E5, F5</b> )  |
| 37-74LS86   | Type-74LS86 Integrated Circuit ( <b>D6</b> )  |
| 37-74LS90   | Type-74LS90 Integrated Circuit ( <b>B5</b> )  |
| 37-74LS139  | Type-74LS139 Integrated Circuit ( <b>C3</b> )   |
| 37-74LS153  | Type-74LS153 Integrated Circuit ( <b>H4, J4, K4, L4, M4, P7</b> )   |
| 37-74LS157  | Type-74LS157 Integrated Circuit ( <b>E7, F7, H7, J7, C6</b> )   |
| 37-74LS163A | Type-74LS163A Integrated Circuit ( <b>M8, K7, P4, P5, P6, N5, N6</b> )  |
| 37-74LS166  | Type-74LS166 Integrated Circuit ( <b>D7, J8</b> )   |
| 37-74LS174  | Type-74LS174 Integrated Circuit ( <b>D5, D8</b> )   |
| 37-74LS175  | Type-74LS175 Integrated Circuit ( <b>L6</b> )   |
| 37-74LS244  | Type-74LS244 Integrated Circuit ( <b>B1, C1</b> )   |
| 37-74LS245  | Type-74LS245 Integrated Circuit ( <b>E2</b> )   |
| 37-74LS257  | Type-74LS257 Integrated Circuit ( <b>L2, K2, M3, M5, F8, H8</b> )   |
| 37-74LS259  | Type-74LS259 Integrated Circuit ( <b>P9</b> )   |
| 37-74LS273  | Type-74LS273 Integrated Circuit ( <b>F4, L7</b> )   |
| 37-74LS373  | Type-74LS373 Integrated Circuit ( <b>F2</b> )   |
| 37-74S04    | Type-74S04 Integrated Circuit ( <b>P3</b> )   |
| 37-74S74    | Type-74S74 Integrated Circuit ( <b>N8</b> )   |
| 38-MV5053   | Type-MV5053 Light-Emitting Diode ( <b>CR1</b> )   |
| 41-3003     | 100 uH, ± 5%, Hot-Molded Plastic Fixed R.F. Choke ( <b>L1</b> )   |
| 62-001      | SPST Momentary Pushbutton Switch ( <b>A7</b> )  |
| 66-114P1T   | 4-Station, Single-Throw, Dual-Inline-Package Bit Switch ( <b>L9</b> )   |
| 66-118P1T   | 8-Station, Single-Throw, Dual-Inline-Package Bit Switch ( <b>J2, M2</b> )                                     |
| 79-42C16    | 16-Contact Medium-Insertion-Force Integrated Circuit Socket ( <b>M6, N7</b> )                                 |
| 79-42C24    | 24-Contact Medium-Insertion-Force Integrated Circuit Socket ( <b>K/L1, M1, D1, E/F1, H1, J/K1, F/H6, E6</b> ) |

*[Continued on next page]*

## Figure 18 Warlords™ Game PCB Assembly, continued Parts List

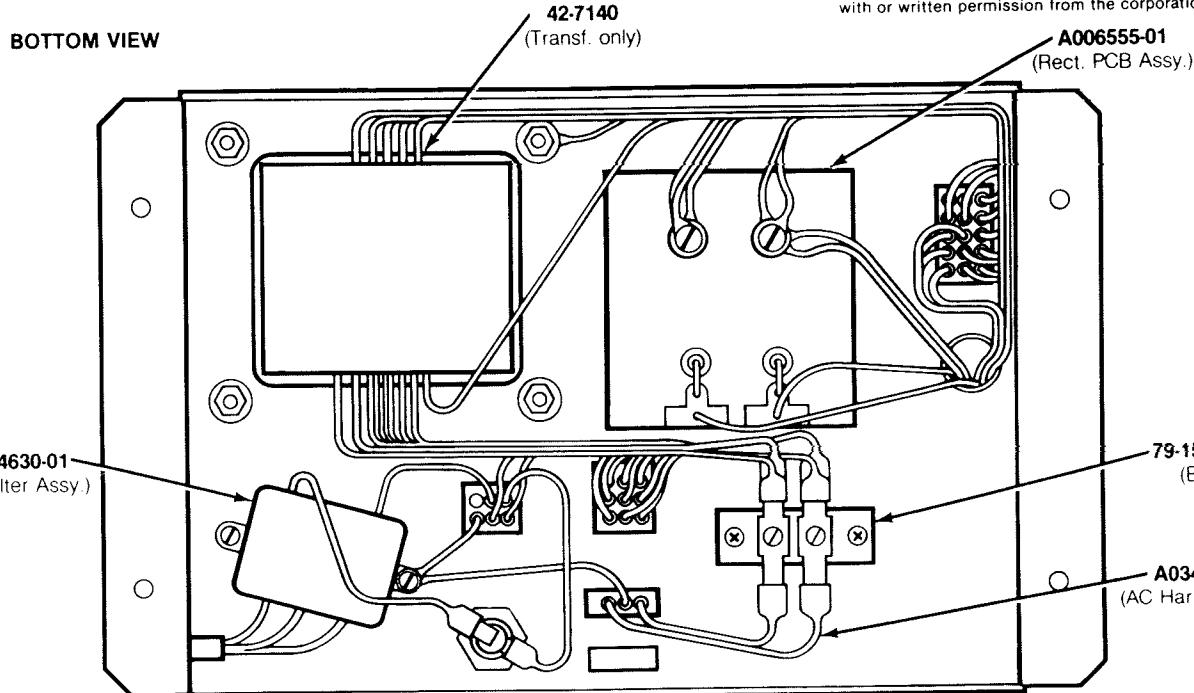
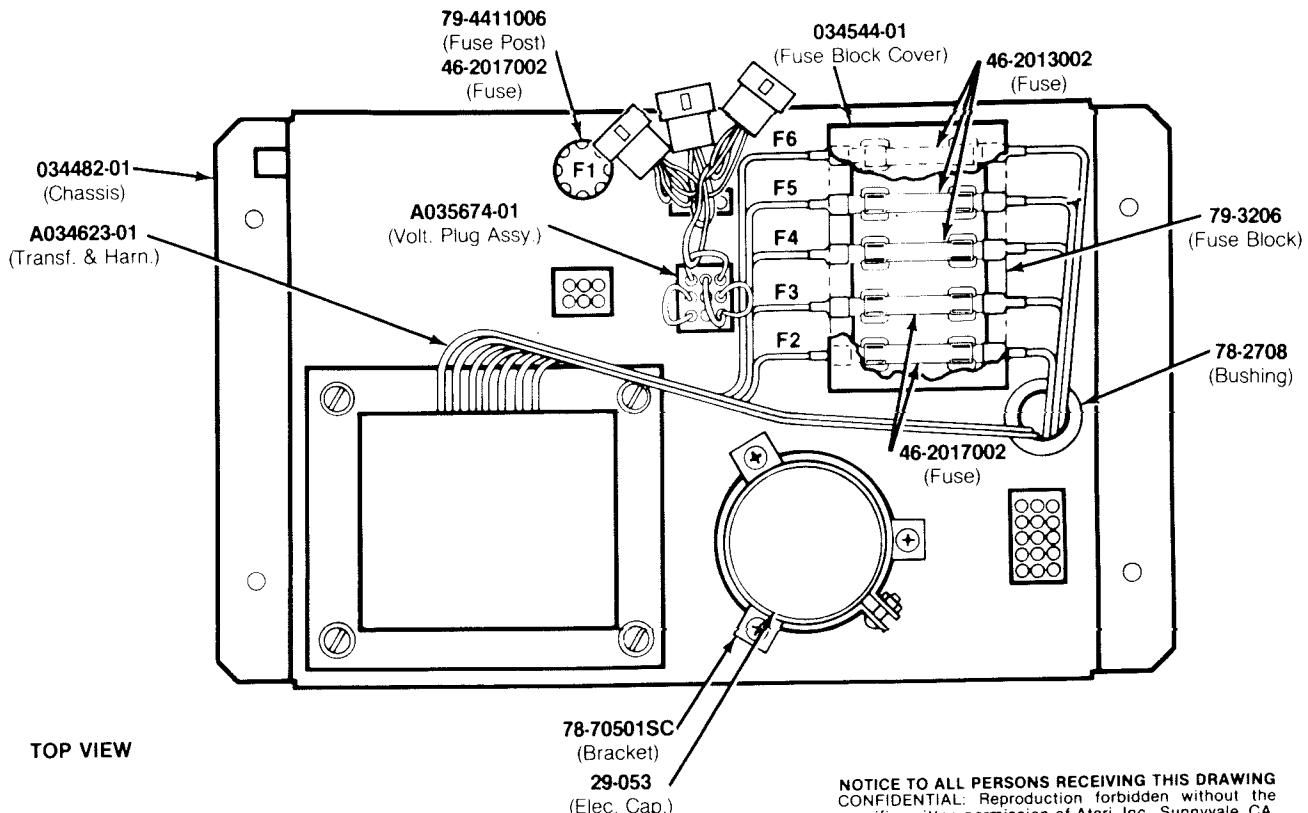
| <i>Part No.</i> | <i>Description (Reference Designations and Locations in Bold)</i>                                  |
|-----------------|--|
| 79-42C40        | 40-Contact Medium-Insertion-Force Integrated Circuit Socket ( <b>B3/4, C2</b> )                    |
| 31-4302         | Nylon Snap-In Fastener ( <b>Q3-5</b> )   |
| 30-102          | 12.096 MHz, ± .005%, Crystal ( <b>Y1</b> )   |
| 30-6010         | Microprocessor ( <b>C2</b> )   |
| 30-7031         | Random-Access Memory ( <b>H3, J3, K3, L3, H5, J5, K5, L5</b> )                                     |
| 30-7033         | Random-Access Memory ( <b>N1, P1</b> )   |
| 30-7035         | Random-Access Memory ( <b>L8, K8</b> )   |
| 20670-01        | Test Point   |
| 37153-01        | Read-Only Memory ( <b>K/L1</b> )   |
| 37154-01        | Read-Only Memory ( <b>M1</b> )   |
| 37155-01        | Read-Only Memory ( <b>D1</b> )   |
| 37156-01        | Read-Only Memory ( <b>E/F1</b> )   |
| 37157-01        | Read-Only Memory ( <b>H1</b> )   |
| 37158-01        | Read-Only Memory ( <b>J/K1</b> )   |
| 37159-01        | Read-Only Memory—Graphics ( <b>E6, F/H6</b> )  |
| 37161-01        | Programmable Read-Only Memory ( <b>M6</b> )  |
| 37235-01        | Programmable Read-Only Memory ( <b>N7</b> )  |
| 300015-103      | .01 uf Ceramic-Disc 25V Radial-Lead Capacitor ( <b>C64</b> )                                       |
| 10000-102       | 1K Ohm, ± 5%, 1/4W Resistor ( <b>R20-23, 26-32, 37, 38, 42, 62-69, 74-81, 84, 85, 88, 90, 91</b> ) |
| 10000-103       | 10K Ohm, ± 5%, 1/4W Resistor ( <b>R1-19, 24, 33, 44, 92, 93, 96</b> )                              |
| 10000-104       | 100K Ohm, ± 5%, 1/4W Resistor ( <b>R50-53</b> )  |
| 10000-105       | 1M Ohm, ± 5%, 1/4W Resistor ( <b>R34</b> )   |
| 10000-122       | 1.2K Ohm, ± 5%, 1/4W Resistor ( <b>R72</b> )   |
| 10000-153       | 15K Ohm, ± 5%, 1/4W Resistor ( <b>R36</b> )  |
| 10000-182       | 1.8K Ohm, ± 5%, 1/4W Resistor ( <b>R71, 73</b> )   |
| 10000-183       | 18K Ohm, ± 5%, 1/4W Resistor ( <b>R87</b> )  |
| 10000-221       | 220 Ohm, ± 5%, 1/4W Resistor ( <b>R45-49, 94</b> )   |
| 10000-471       | 470 Ohm, ± 5%, 1/4W Resistor ( <b>R54-61, 82, 83</b> )   |
| 10000-472       | 4.7K Ohm, ± 5%, 1/4W Resistor ( <b>R25</b> )   |
| 10000-563       | 56K Ohm, ± 5%, 1/4W Resistor ( <b>R35</b> )  |
| 10000-681       | 680 Ohm, ± 5%, 1/4W Resistor ( <b>R95</b> )  |
| 31008-105       | 1 uf, ± 10%, Polyester 50V Radial-Lead Capacitor ( <b>C44</b> )                                    |
| 32002-102       | .001 uf Ceramic-Disc 25V Radial-Lead Capacitor ( <b>C36</b> )                                      |
| 32004-224       | .22 uf Ceramic-Disc 25V Radial-Lead Capacitor ( <b>C67</b> )                                       |
| 31000-001       | 3.9 V, ± 10%, 0.4 W, Type-1N748 Zener Diode ( <b>CR4</b> )   |



**Figure 19 Control Panel Assembly  
A037211-01 A**

### Parts List

| Part No.   | Description   |
|------------|---|
| A037206-01 | Control Panel with Graphics                                     |
| A037234-01 | Control Harness Assembly  |
| 19-9022    | 5K Ohm, ± 20%, Linear Slip-Clutch Potentiometer                 |
| 62-039     | Momentary-Contact SPDT Light-Emitting-Diode Switch with Red Cap |
| 73-834     | Black Knob with Skirt   |
| 75-07054   | Spacer for Light-Emitting-Diode Switch                          |
| 75-9910W0  | #15/32-32 Steel Stamped Nut                                     |
| 033127-01  | Black Molded Switch Bushing                                     |

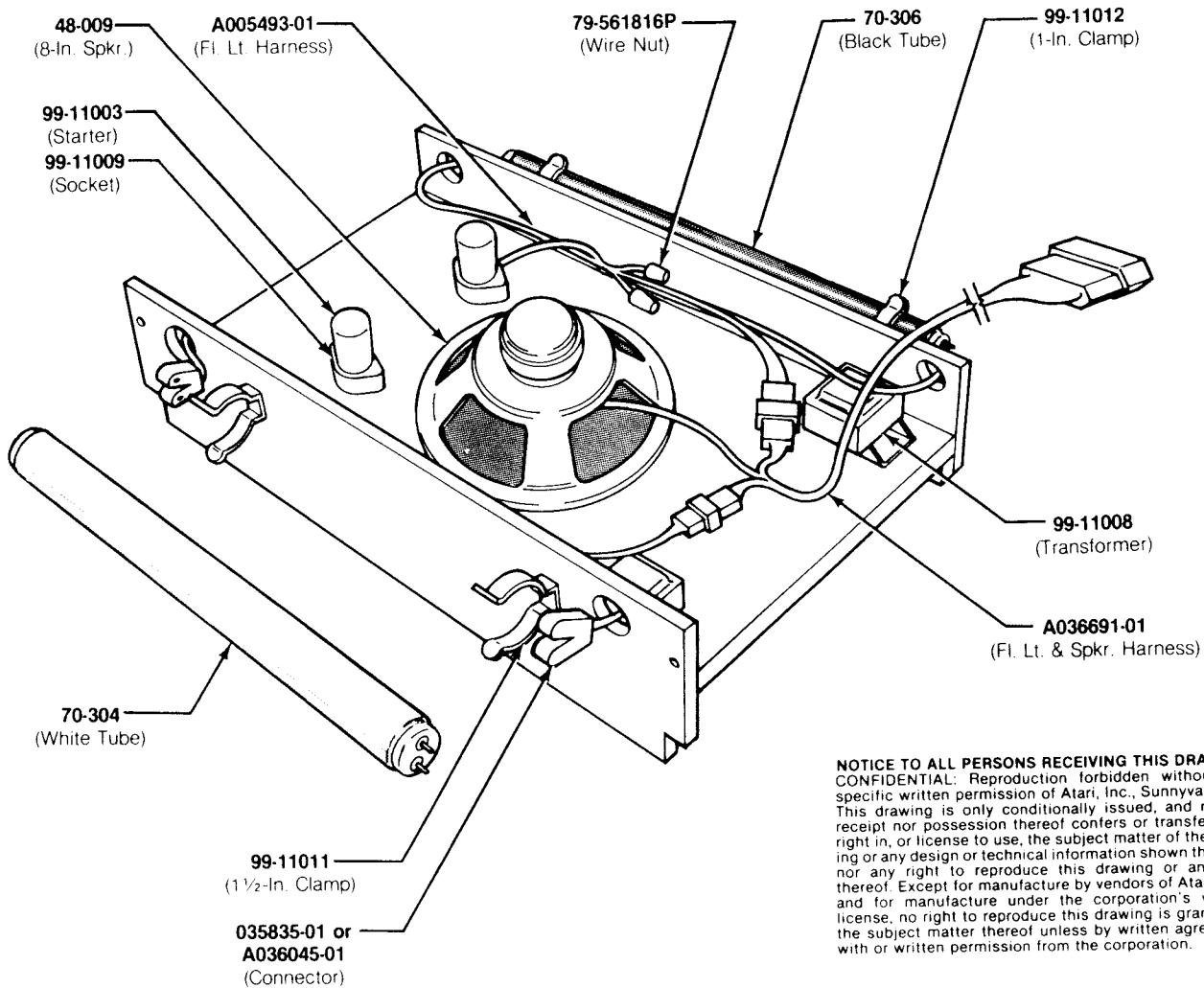


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**Figure 20 Power Supply Assembly for Raster-Scan Games  
A034560-02 D**

## Figure 20 Power Supply Assembly for Raster-Scan Games Parts List

| Part No.    | Description (Reference Designations in Bold)   |
|-------------|--|
| A006555-01  | Rectifier Printed-Circuit Board Assembly   |
| A034623-01  | Transformer and Harness Assembly ( <b>T1</b> )   |
| A034629-01  | AC Harness Assembly  |
| A034630-01  | RFI Filter Assembly ( <b>FL1</b> )   |
| A035674-01  | Voltage Plug Assembly ( <i>set of four plugs</i> )   |
| 29-053      | 26,000 uf 15V Electrolytic Capacitor ( <b>C1</b> )   |
| 42-7140     | Power Transformer Only ( <b>T1</b> )   |
| 46-2013002  | 3-Amp. 250V 3AG Slow-Blow Glass Cartridge-Type Fuse ( <b>F4, F5, F6</b> )                                |
| 46-2017002  | 7-Amp. 250V 3AG Slow-Blow Glass Cartridge-Type Fuse ( <b>F1, F2, F3</b> )                                |
| 78-2708     | Nylon Type 6/6 Hole Bushing with 5/8-Inch Inside Diameter x 55/64-Inch Outside Diameter x 1/4-Inch Thick |
| 78-70501SC  | 2-Inch-Diameter Capacitor Mounting Bracket   |
| 79-15021001 | 2-Circuit Single-Row Terminal Block  |
| 79-3206     | 5-Position 3AG Fuse Block with 1/4-Inch Quick-Disconnect Terminals                                       |
| 79-4411006  | Panel-Mounting Non-Indicating 3AG Cartridge-Type Fuse Post   |
| 034544-01   | Fuse Block Cover   |



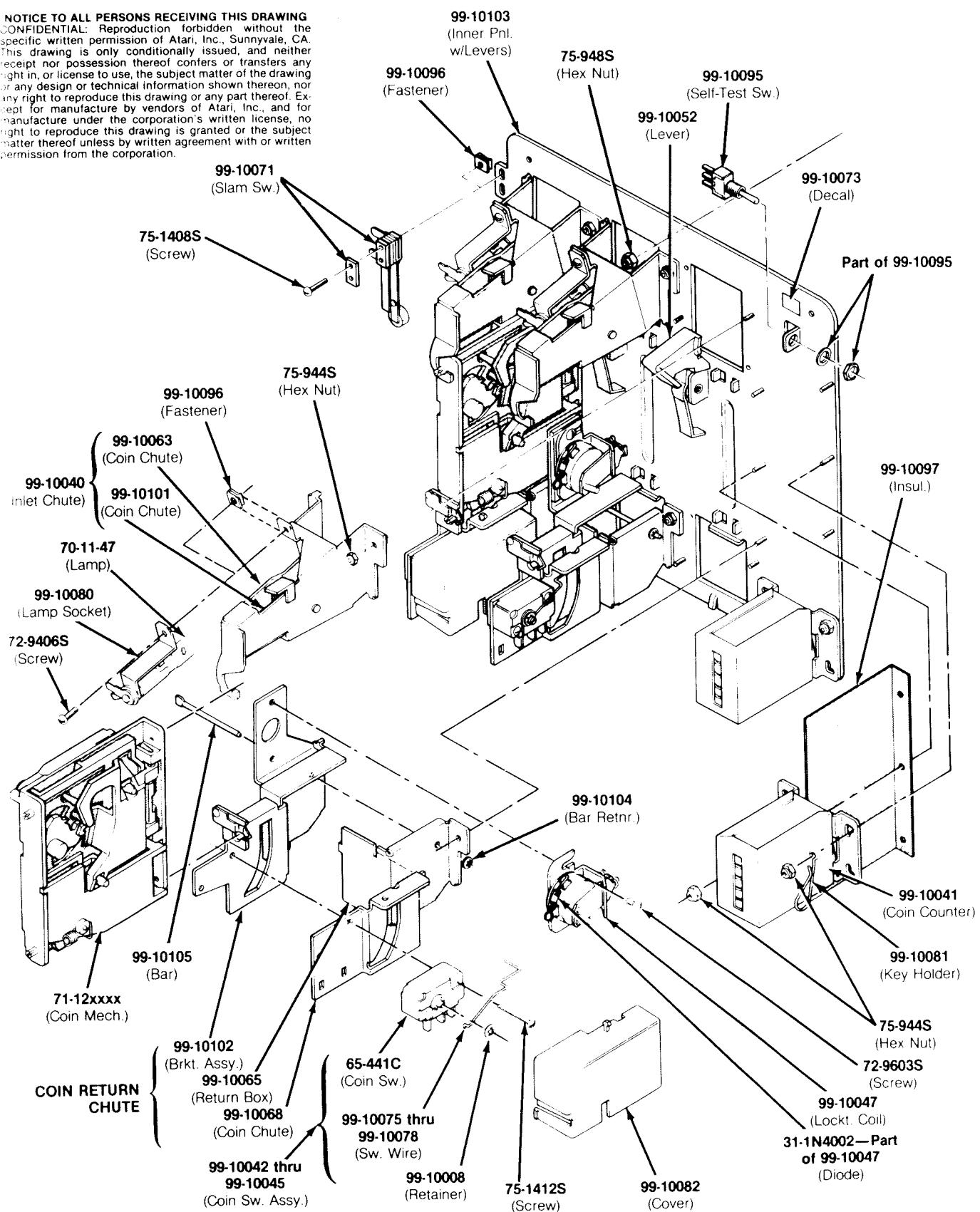
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**Figure 21 Fluorescent Light and Speaker Assembly**  
**A036610-01 B**

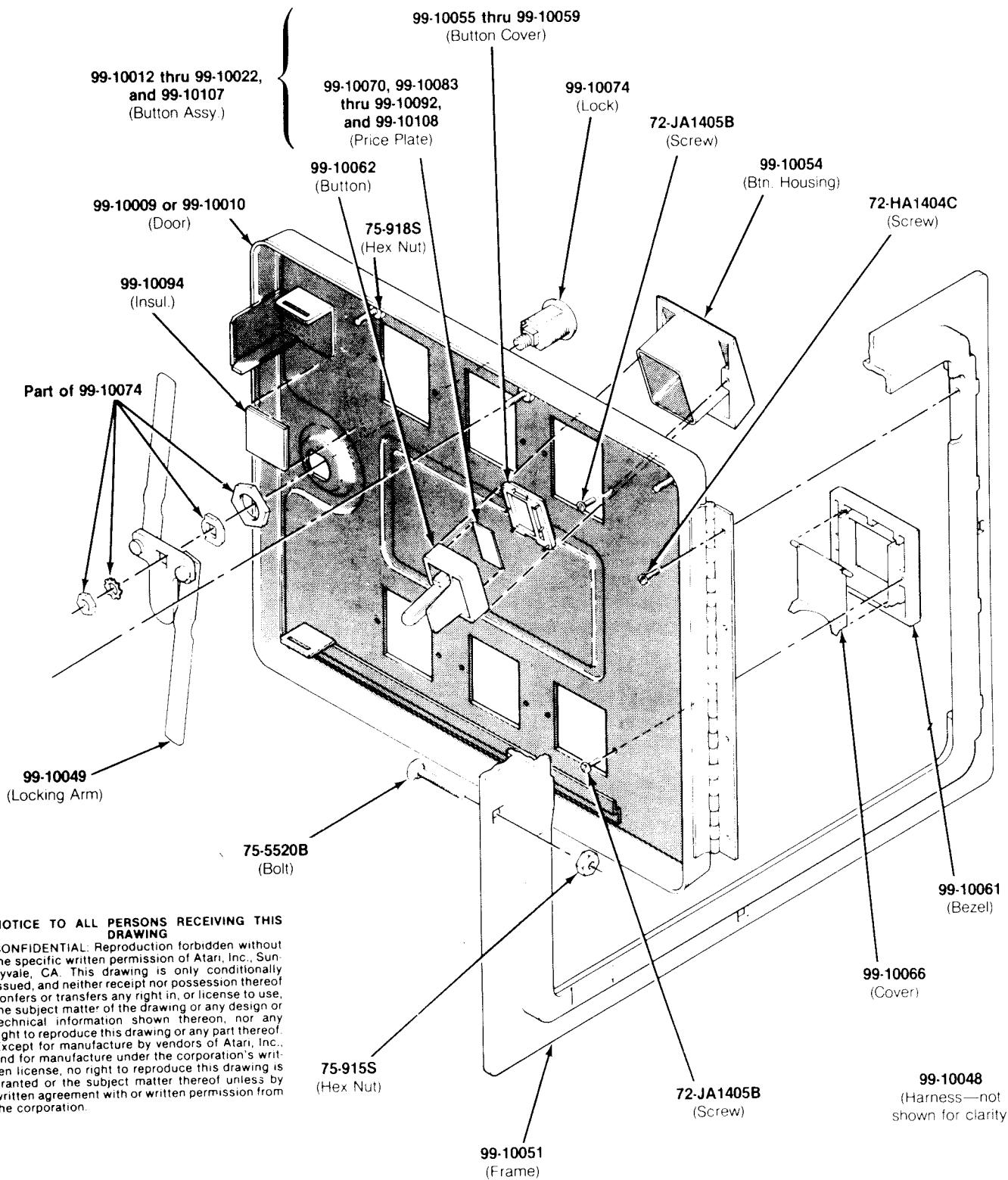
## Figure 21 Fluorescent Light and Speaker Assembly, continued Parts List

| Part No.   | Description   |
|------------|---|
| A005493-01 | Fluorescent Light Harness   |
| A036691-01 | Fluorescent Light and Speaker Harness                                     |
| 48-009     | 8-Inch High-Fidelity Speaker  |
| 70-304     | 18-Inch 15-Watt Cool White Fluorescent Tube                               |
| 70-306     | 18-Inch 15-Watt Blacklight Fluorescent Tube                               |
| 79-561816P | Spring Connector Wire Nut for 16- to 18-Guage Wires                       |
| 99-11003   | Fluorescent Lamp Starter  |
| 99-11008   | Ballast Transformer   |
| 99-11009   | Starter Socket  |
| 99-11011   | 1½-Inch Clamp <i>(for white tube)</i>                                     |
| 99-11012   | 1-Inch Clamp <i>(for blacklight tube)</i>                                 |
| 035835-01  | Y-Lead Connector <i>(part no. A036045-01 is an acceptable substitute)</i> |

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**Figure 22 American-Made Coin Door**  
**71-10xxxx D**



71-102201 — U.S. 25¢/25¢ Coin Door  
 71-103202 — U.S. 25¢/25¢/25¢ Coin Door  
 71-103203 — U.S. 25¢/25¢/\$1 Coin Door  
 71-102204 — German 2 DM/1 DM Coin Door  
 71-103205 — German 1/2/5 DM Coin Door

71-102206 — German 1 DM/5 DM Coin Door  
 71-102207 — Belgian 5 Fr/5 Fr Coin Door  
 71-102208 — Swiss 1 Fr/1 Fr Coin Door  
 71-102209 — Japanese 100Y/100Y Coin Door  
 71-102210 — British 10 P/10 P Coin Door

71-102211 — Australian 20¢/20¢ Coin Door  
 71-102212 — Italian 100 L/100 L Coin Door  
 71-102213 — U.S. 50¢/50¢ (2 x 25¢) Coin Door  
 71-103214 — U.S. 50¢/50¢/50¢ Coin Door  
 71-103215 — U.S. 50¢/50¢/\$1 Coin Door

**Figure 22 American-Made Coin Door**  
**71-10xxxx D**

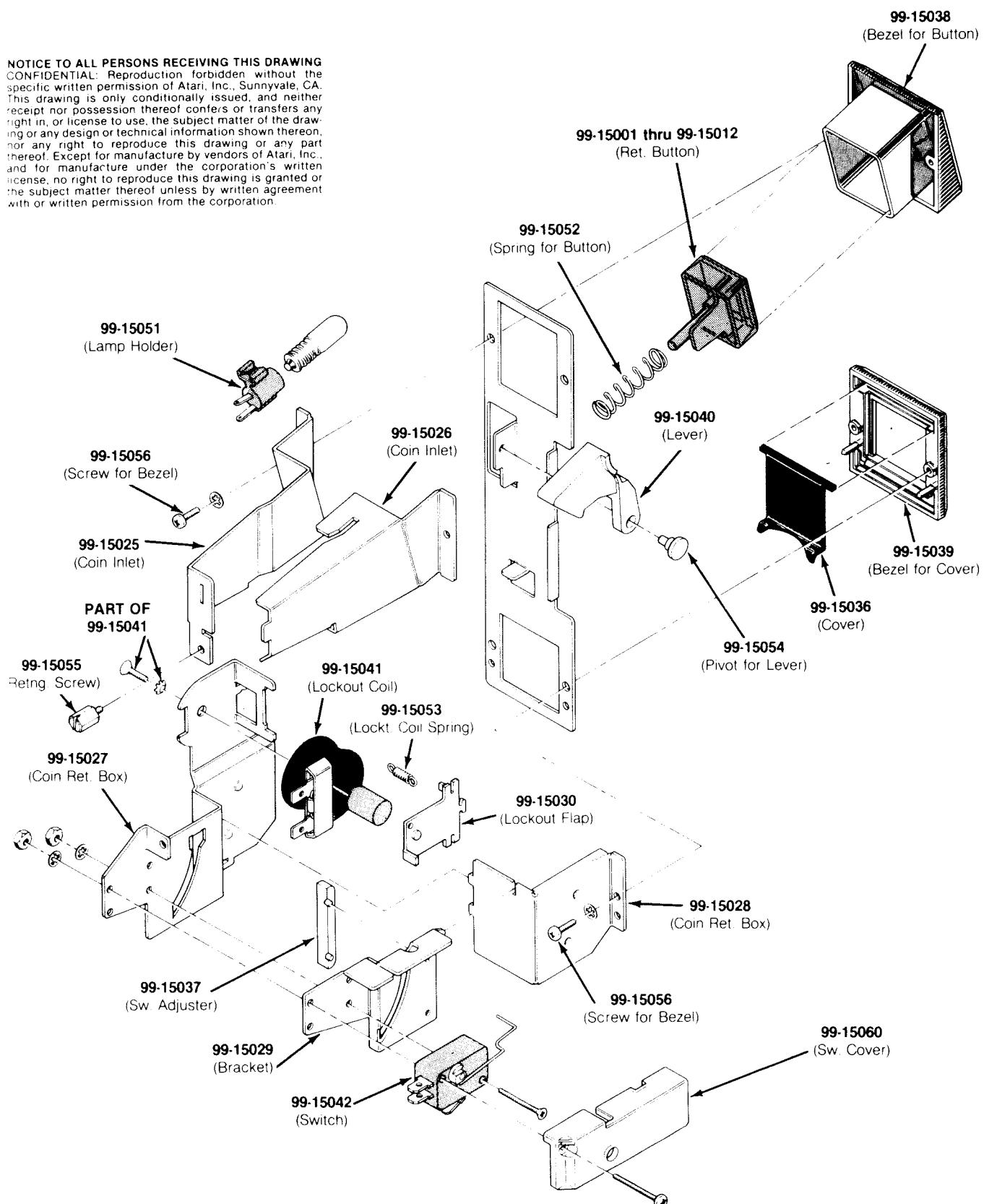
## Figure 22 American-Made Coin Door, continued Parts List

| <i>Part No.</i> | <i>Description</i>   |
|-----------------|--|
| 31-1N4002       | 100V Silicon Rectifier 1N4002 Diode  |
| 65-441C         | General-Usage Low-Force Miniature Switch   |
| 70-11-47        | Miniature Bayonet-Base Incandescent Lamp, Type #47   |
| 71-1201ADU      | U.S. \$1.00 Coin Mechanism   |
| 71-1201FCH      | Swiss 1 Fr Coin Mechanism  |
| 71-1201MG       | German 1 DM Coin Mechanism   |
| 71-1202MG       | German 2 DM Coin Mechanism   |
| 71-1205FB       | Belgian 5 Fr Coin Mechanism  |
| 71-1205MG       | German 5 DM Coin Mechanism   |
| 71-1210PE       | U.K. 10 P Coin Mechanism   |
| 71-1220CA       | Australian 20¢ Coin Mechanism  |
| 71-1225CU       | U.S. 25¢ Coin Mechanism  |
| 71-12100LI      | Italian 100 Lire Coin Mechanism  |
| 71-12100YJ      | Japanese Y100 Coin Mechanism   |
| 72-HA1404C      | #4 x 1/4-Inch Slotted Pan-Head Thread-Rolling Tri-Fluted "Taptite" Cadmium-Plated Screw            |
| 72-JA1405B      | #4 x 5/16-Inch Slotted Pan-Head Thread-Rolling Tri-Fluted "Plastite" Black Screw                   |
| 72-9406S        | #4-40 x 3/8-Inch Slotted Truss-Head Steel Machine Screw  |
| 72-9603S        | #6-32 x 3/16-Inch Slotted Truss-Head Steel Machine Screw   |
| 75-915S         | #1/4-20 Standard-Pattern Cadmium-Plated Steel Hex Nut  |
| 75-918S         | #8-32 Standard-Pattern Cadmium-Plated Steel Hex Nut  |
| 75-944S         | #4-40 Polymer Self-Locking Steel Hex Nut   |
| 75-948S         | #8-32 Polymer Self-Locking Steel Hex Nut   |
| 75-1408S        | #4-40 x 1/2-Inch Slotted Pan-Head Steel Machine Screw  |
| 75-1412S        | #4-40 x 3/4-Inch Slotted Pan-Head Steel Machine Screw  |
| 75-5520B        | #1/4-20 x 1 1/4-Inch Round-Head Square-Neck Steel Bolt with Black Finish                           |
| 99-10008        | Switch Wire Retainer   |
| 99-10009        | 2-Mech Coin Door Only  |
| 99-10010        | 3-Mech Coin Door Only  |
| 99-10012        | U.S. 25¢ Coin Return Button Assembly   |
| 99-10013        | U.S. \$1.00 Coin Return Button Assembly  |
| 99-10014        | German 1 DM Coin Return Button Assembly  |
| 99-10015        | German 2 DM Coin Return Button Assembly  |
| 99-10016        | German 5 DM Coin Return Button Assembly  |
| 99-10017        | Belgian 5 Fr Coin Return Button Assembly   |
| 99-10018        | Swiss 1 Fr Coin Return Button Assembly   |
| 99-10019        | Japanese Y100 Coin Return Button Assembly  |
| 99-10020        | U.K. 10 P Coin Return Button Assembly  |
| 99-10021        | Australian 20¢ Coin Return Button Assembly   |
| 99-10022        | Italian 100 Lire Coin Return Button Assembly   |
| 99-10040        | Coin Inlet Chute Assembly  |
| 99-10041        | Coin Counter Assembly  |
| 99-10042        | Coin Switch Assembly for U.S. 25¢ and Belgian 5 Fr Coins ( <i>silver wire</i> )                    |
| 99-10043        | Coin Switch Assembly for German 1 DM, Swiss 1 Fr, and Japanese Y100 Coins ( <i>black wire</i> )    |
| 99-10044        | Coin Switch Assembly for U.S. \$1.00, German 2 DM, and Italian 100 Lire Coins ( <i>gold wire</i> ) |
| 99-10045        | Coin Switch Assembly for German 5 DM, U.K. 10 P, and Australian 20¢ Coins ( <i>green wire</i> )    |

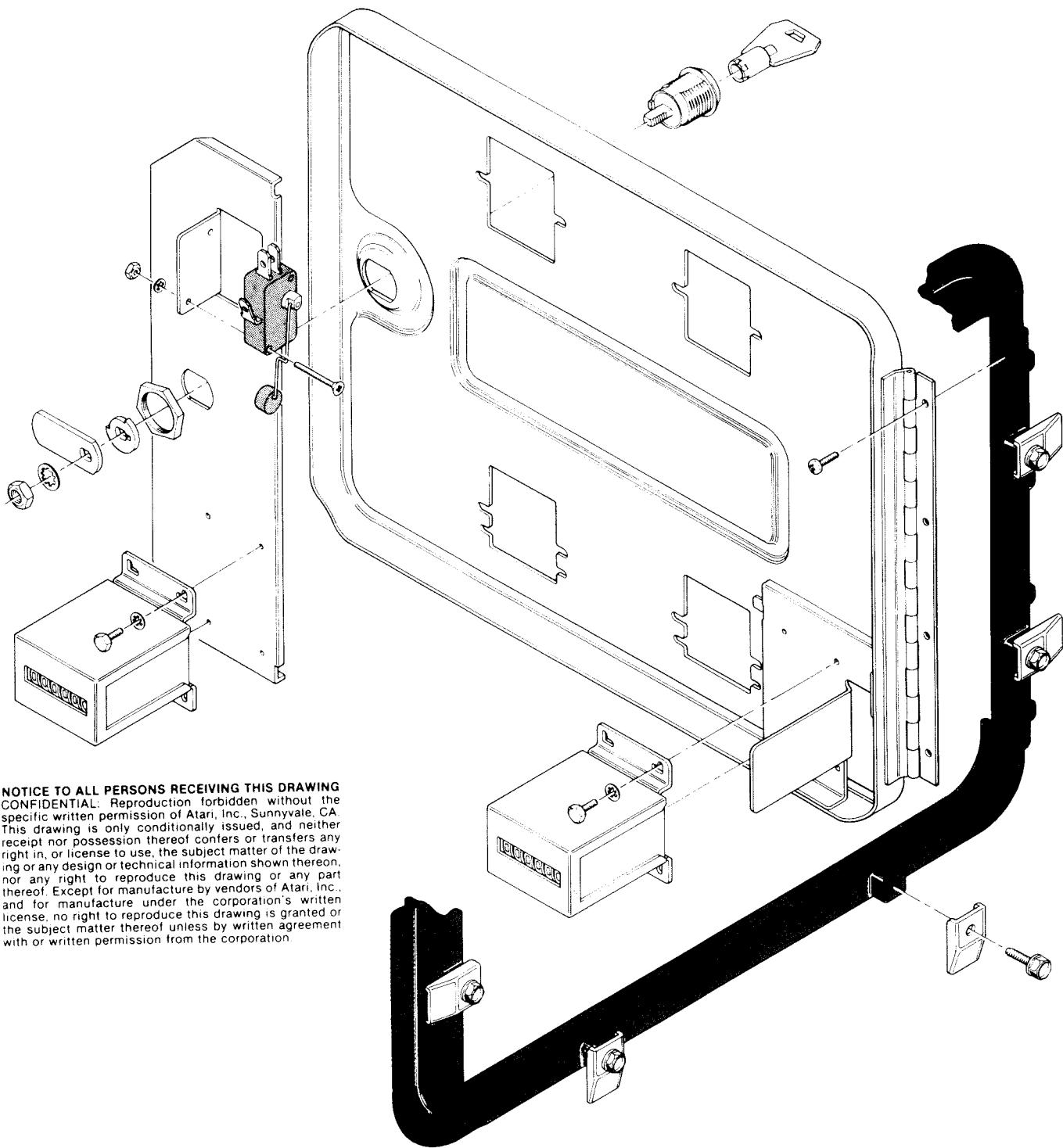
## Figure 22 American-Made Coin Door, continued Parts List

| <i>Part No.</i> | <i>Description</i>  |
|-----------------|---|
| 99-10047        | Lockout Coil Assembly   |
| 99-10048        | Coin Door Harness Assembly  |
| 99-10049        | Locking Arm Assembly  |
| 99-10051        | Coin Door Frame   |
| 99-10052        | Coin Return Lever   |
| 99-10054        | Coin Button Housing   |
| 99-10055        | Coin Return Button Cover for Japanese 100Y Coin                                   |
| 99-10056        | Coin Return Button Cover for German 1 DM and Swiss 1 Fr Coins                     |
| 99-10057        | Coin Return Button Cover for U.S. 25¢ and Belgian 5 Fr Coins                      |
| 99-10058        | Coin Return Button Cover for U.S. \$1.00, German 2 DM, and Italian 100 Lire Coins |
| 99-10059        | Coin Return Button Cover for German 5 DM, U.K. 10 P, and Australian 20¢ Coins     |
| 99-10061        | Coin Return Bezel   |
| 99-10062        | Coin Return Button  |
| 99-10063        | Right Half of Coin Inlet Chute  |
| 99-10065        | Coin Return Box   |
| 99-10066        | Coin Return Cover   |
| 99-10068        | Coin Chute  |
| 99-10070        | U.S. 25¢ Price Plate  |
| 99-10071        | Slam Switch Assembly  |
| 99-10073        | Test Switch Decal   |
| 99-10074        | Lock Assembly   |
| 99-10075        | Black Switch Wire for German 1 DM, Swiss 1 Fr and Japanese 100Y Coins             |
| 99-10076        | Silver Switch Wire for U.S. 25¢ and Belgian 5 Fr Coins                            |
| 99-10077        | Gold Switch Wire for U.S. \$1.00, German 2 DM and Italian 100 Lire Coins          |
| 99-10078        | Green Switch Wire for German 5 DM, U.K. 10 P and Australian 20¢ Coins             |
| 99-10080        | Miniature Bayonet-Base Lamp Socket  |
| 99-10081        | Wire Key Holder   |
| 99-10082        | Switch Cover  |
| 99-10083        | U.S. \$1.00 Price Plate   |
| 99-10084        | German 1 DM Price Plate   |
| 99-10085        | German 2 DM Price Plate   |
| 99-10086        | German 5 DM Price Plate   |
| 99-10087        | Belgian 5 Fr Price Plate  |
| 99-10088        | Swiss 1 Fr Price Plate  |
| 99-10089        | Japanese Y100 Price Plate   |
| 99-10090        | U.K. 10 P Price Plate   |
| 99-10091        | Australian 20¢ Price Plate  |
| 99-10092        | Italian 100 Lire Price Plate  |
| 99-10094        | Fish Paper Insulation   |
| 99-10095        | Toggle Switch   |
| 99-10096        | "U"-Type Fastener   |
| 99-10097        | Fish Paper Insulation   |
| 99-10101        | Left Half of Coin Inlet Chute   |
| 99-10102        | Switch and Lockout Coil Bracket Sub-Assembly                                      |
| 99-10103        | Inner Panel with Levers Sub-Assembly  |
| 99-10104        | Anti-Penny-Flip Bar Retainer  |
| 99-10105        | Anti-Penny-Flip Bar   |
| 99-10107        | U.S. 50¢ Coin Return Button Assembly (for two quarters)                           |
| 99-10108        | U.S. 50¢ Price Plate (for two quarters)   |

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**Figure 23 British-Made Coin Door**  
**171000-xxx A**



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171001-001 — British 10 P/10 P Coin Door  
 171000-002 — British 10 P/50 P Coin Door  
 171000-003 — British 20 P/50 P Coin Door  
 171000-004 — German 1 DM/1 DM Coin Door  
 171000-005 — German 2 DM/1 DM Coin Door

171000-006 — German 2 DM/5 DM Coin Door  
 171000-007 — Belgian 5 Fr/5 Fr Coin Door  
 171000-008 — French 1 Fr/1 Fr Coin Door  
 171000-009 — French 2 Fr/1 Fr Coin Door  
 171000-010 — Swedish 1 Kr/1 Kr Coin Door

171000-011 — Hong Kong \$1/\$1 Coin Door  
 171000-012 — Canadian 25¢/25¢ Coin Door  
 171000-013 — U.S. 25¢/25¢ Coin Door  
 171000-014 — Spanish 25 Pts/25 Pts Coin Door  
 171000-015 — Swiss 1 Fr/1 Fr Coin Door

**Figure 23 British-Made Coin Door**  
**171000-xxx A**

## Figure 23 British-Made Coin Door, continued Parts List

| <i>Part No.</i> | <i>Description</i>                                     |
|-----------------|--|
| 99-15001        | Coin Return Button with U.S. 25¢ Price Plate           |
| 99-15002        | Coin Return Button with U.S. \$1 Price Plate           |
| 99-15003        | Coin Return Button with German 1 DM Price Plate        |
| 99-15004        | Coin Return Button with German 2 DM Price Plate        |
| 99-15005        | Coin Return Button with German 5 DM Price Plate        |
| 99-15006        | Coin Return Button with Belgian 5 Fr Price Plate       |
| 99-15007        | Coin Return Button with French 1 Fr Price Plate        |
| 99-15008        | Coin Return Button with Japanese 100 Yen Price Plate   |
| 99-15009        | Coin Return Button with British 10 Pence Price Plate   |
| 99-15010        | Coin Return Button with Australian 20¢ Price Plate     |
| 99-15011        | Coin Return Button with Italian 100 Lire Price Plate   |
| 99-15012        | Coin Return Button with U.S. 50¢ (2 x 25¢) Price Plate |
| 99-15025        | Left Half of Coin Inlet                                |
| 99-15026        | Right Half of Coin Inlet                               |
| 99-15027        | Side Plate of Coin Return Box                          |
| 99-15028        | Base Plate of Coin Return Box                          |
| 99-15029        | Switch Bracket   |
| 99-15030        | Flap for Lockout Coil (U.S. 25¢)                       |
| 99-15036        | Coin Return Cover                                      |
| 99-15037        | Switch Adjuster  |
| 99-15038        | Bezel for Coin Return Button                           |
| 99-15039        | Bezel for Coin Return Cover                            |
| 99-15040        | Coin Return Lever                                      |
| 99-15041        | Lockout Coil   |
| 99-15042        | Coin Switch for U.S. 25¢                               |
| 99-15051        | Lamp Holder  |
| 99-15052        | Spring for Coin Return Button                          |
| 99-15053        | Spring for Lockout Coil                                |
| 99-15054        | Pivot for Coin Return Lever                            |
| 99-15055        | Retaining Screw  |
| 99-15056        | Screw for Both Bezels                                  |
| 99-15060        | Switch Cover   |

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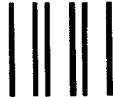
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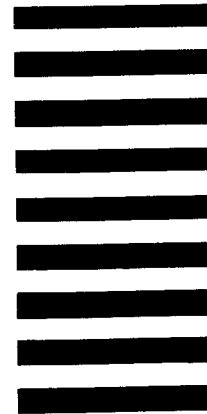
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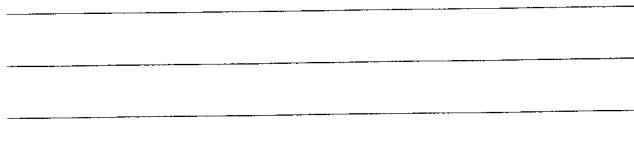
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